OCT 17 1961

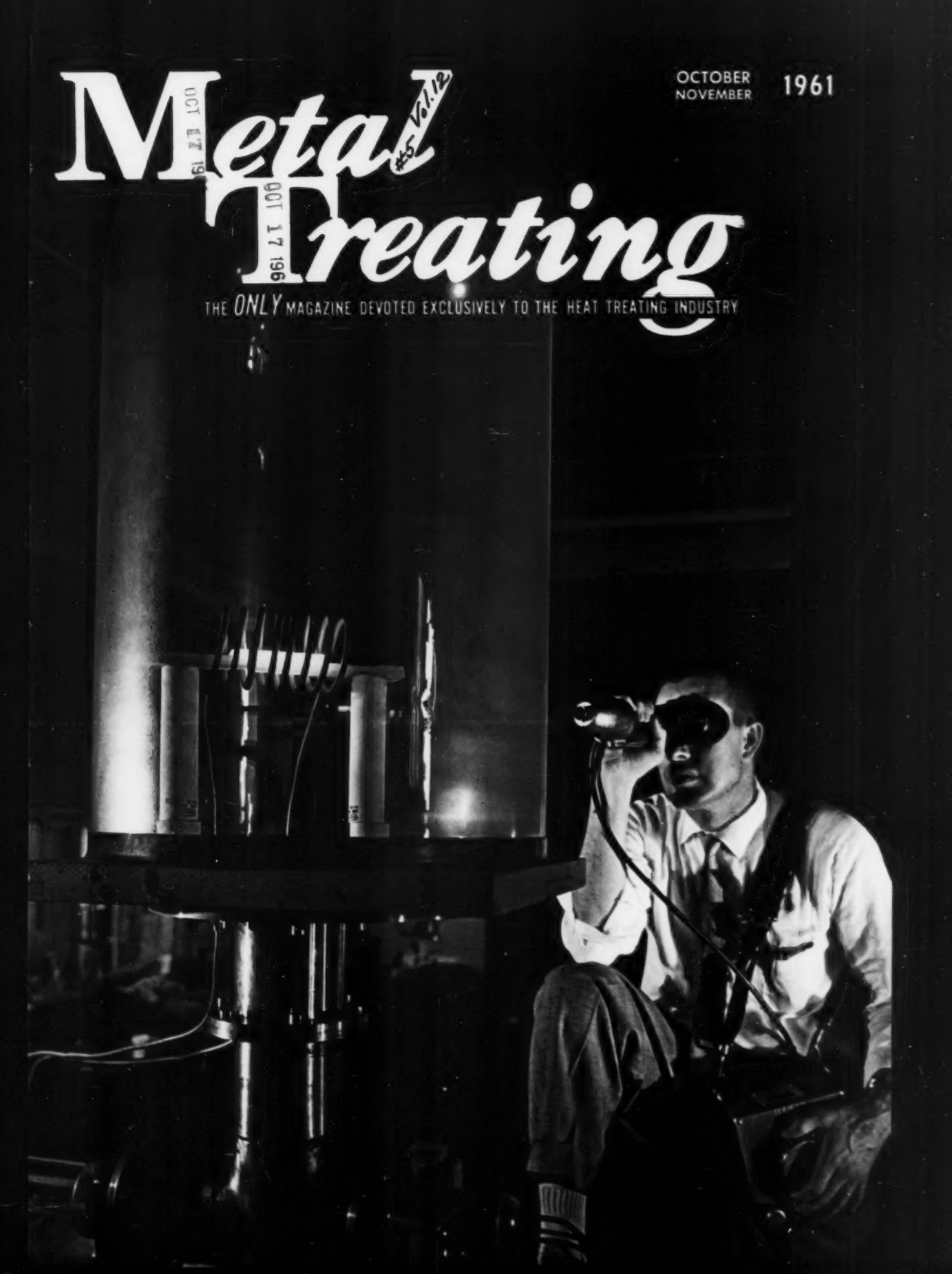
#5 Vol. 12

OCT 17 1961

Metal Treating

OCTOBER
NOVEMBER 1961

THE *ONLY* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY



SUN QUENCHING OILS

Keep coolers cleaner longer . . . combine quality with economy

1 Get Low Operating Cost From Natural Detergency

Sun Quenching Oil Light is a naphthenic quenching oil with a natural detergency that keeps coolers clean. One large auto manufacturer reported a cost drop of over 90% in cooler maintenance after switching to Sun Quenching Oil Light.

2 Get Maximum Physicals In Your Steel

Sunquench 1070 is particularly important in fast-quenching operations because it cools at the optimum rate during the critical stage, minimizes distortion, deepens hardness. With Sunquench 1070, you may be able to substitute lower alloy steels for more expensive grades. Exceptional thermal stability of Sunquench 1070 means long life.

3 Get Brighter Parts

Sun Quenching Oil 11 is a premium-quality paraffinic quenching oil designed for work requiring an oil with a high flash point. It is particularly good for bright quenching. Its high thermal stability prevents decomposition and the resultant streaks on bright-quenched parts.

4 Get Longer Marquench Oil Life

Sun Marquenching Oils are dewaxed paraffinic oils made for controlled martempering at temperatures as high as 400 F High flash and fire points keep Sun Marquenching Oils safe. High oxidation-resistance increases their useful life in your quench tank.

TALK QUENCHING with the Sun man. He'll show you how one or more of these Sun Quenching Oils can handle all of your needs. Or write to Dept. MR-10.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

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For further information circle No. 1

Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

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About Our Cover

Bell jar vacuum chamber used for the determination of evaporation rates of metal in vacuum. Samples were heated with high frequency induction. Both an optical pyrometer and a thermocouple were used for temperature measurement. For the story, see page 16.

Heat resistance plus high hot-strength are critical requirements in these heavily-loaded trays and fixtures, carrying truck gears through a carburizing system. Trays and fixtures are Type HT* high-nickel alloy castings. This alloy is one of five whose high-nickel content—over 25%—gives them unequalled resistance to elevated temperatures and carburizing atmospheres.

High-nickel alloy castings help solve the problem of thermal fatigue

What's your problem with thermal fatigue? You can probably solve it, economically, by selecting from today's high-nickel casting alloys. Their strength and ductility combined with a relatively low coefficient of thermal expansion result in high resistance to repeated thermal shocks. They're delivering impressive service in heat treating, chemical processing and many other demanding applications.

In this versatile family of austenitic nickel-chromium-iron alloys, you'll find useful strength and long life at temperatures from 1200 to 2300°F.

You'll find remarkable combinations of high tensile strengths, stress-to-rupture values, creep resistance. You'll find properties to withstand many oxidizing and reducing environments, carburizing and nitriding atmospheres.

Special resistance to scaling, to thermal shock, stress-corrosion cracking or sigma phase embrittlement are among other useful properties offered by alloys in this group.

And there's valuable design information—plus full data on these alloys—in the new 64-page booklet, "Heat Resistant Castings, Corrosion Resistant Castings . . . Their Engineering Properties and Applications." A copy is yours for the asking.

*Alloy Casting Institute designation

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

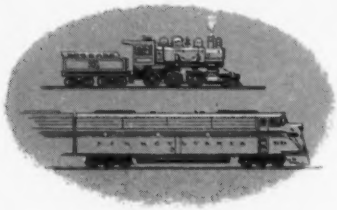
For further information circle No. 2

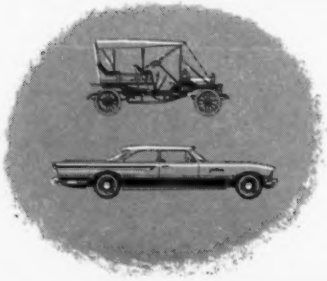
VISIT Park BOOTH No. 907

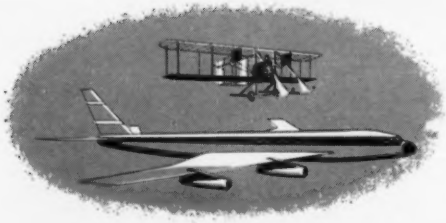
at the Metal Show...

Oct. 23 to 27 • Cobo Hall, Detroit

50 years of service on heat treating materials







Some things change drastically in fifty years; several are shown on this page. Other things change, too, but less noticeably — heat treatment of metals for example. Companies grow and prosper by helping to cause these changes and advancements. The Park Chemical Company started the manufacture of an improved carburizing compound for steel parts in 1911. Through the years they have developed better carburizing compounds, water-soluble and deep-case liquid carburizing salts, neutral salts and methods to maintain their neutrality, aluminum and magnesium brazing salts, quenching and tempering salts and oils, and protective coatings. With all their growth and change, one thing remains the same: a desire to help the heat treater with his problems.

Park's philosophy of service persists unaltered although greatly broadened in scope through greater laboratory facilities and more personnel. Why don't you take advantage of Park's fifty years experience in solving heat treating problems? Make a change for the better—get in touch with your local Park Representative or write us direct.

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HONEYWELL

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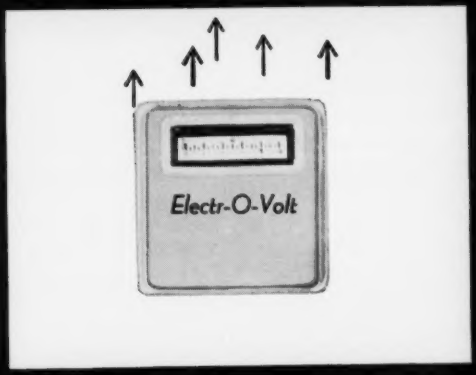
CLOSE
OPEN

AUTO.
MAN.
PWR ON
ON
OFF
Electr-O-Pulse
LOAD ON
CYCLE TIME
MANUAL
PROP. BAND
ADJUST.


Electr-O-Volt

Three ways to get peak performance from your furnaces!

1. Electr-O-Line Control Unit for position-proportioning control with reset and rate action
2. Electr-O-Pulse Control Unit for time proportioning control with reset and rate action
3. Electr-O-Volt Control Unit for current-proportioning control with reset and rate action

These new Honeywell three-mode control units can actually improve the performance of your furnaces by providing the exact temperature that's needed. They include features that cannot be matched:

Smooth three-mode control with extra-wide band adjustments. You can adjust the proportional band up to 500%; reset action from 0 to 100 repeats per minute; and rate time from 0 to 10 minutes. Proportional band can be readjusted without upsetting the process. Special rate circuit minimizes overshoot in batch processes and during startup. Auto-man switching on all units is bumpless.

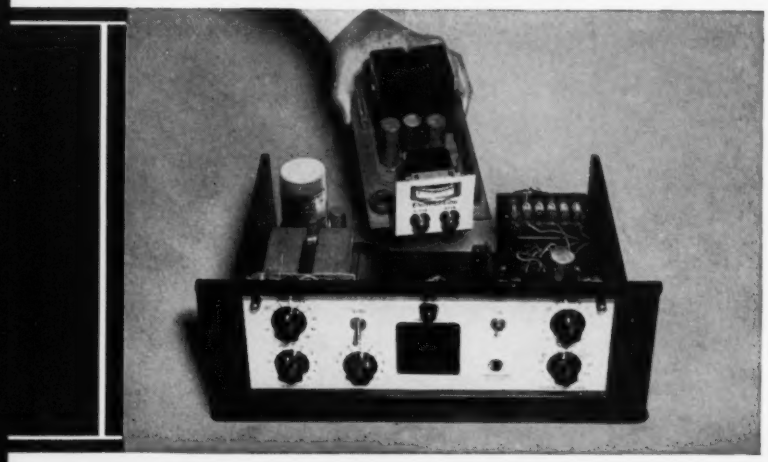
Modular construction with interchangeable control output sections. Modular plug-in construction is used throughout. Amplifier and power supply sections are the same for all three units. Only the control output section changes. Interchangeability of this section simplifies stocking and servicing.

ElectroniK Strip Chart, Circular Chart, and Circular Scale Controllers are used with Electr-O-Line, Electr-O-Pulse, and Electr-O-Volt units. They are integrally mounted, simplifying panel cutout and reducing wiring costs.

For more complete details on these and other types of furnace controls, contact your nearby Honeywell field engineer. He's as near as your phone. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control* SINCE 1885

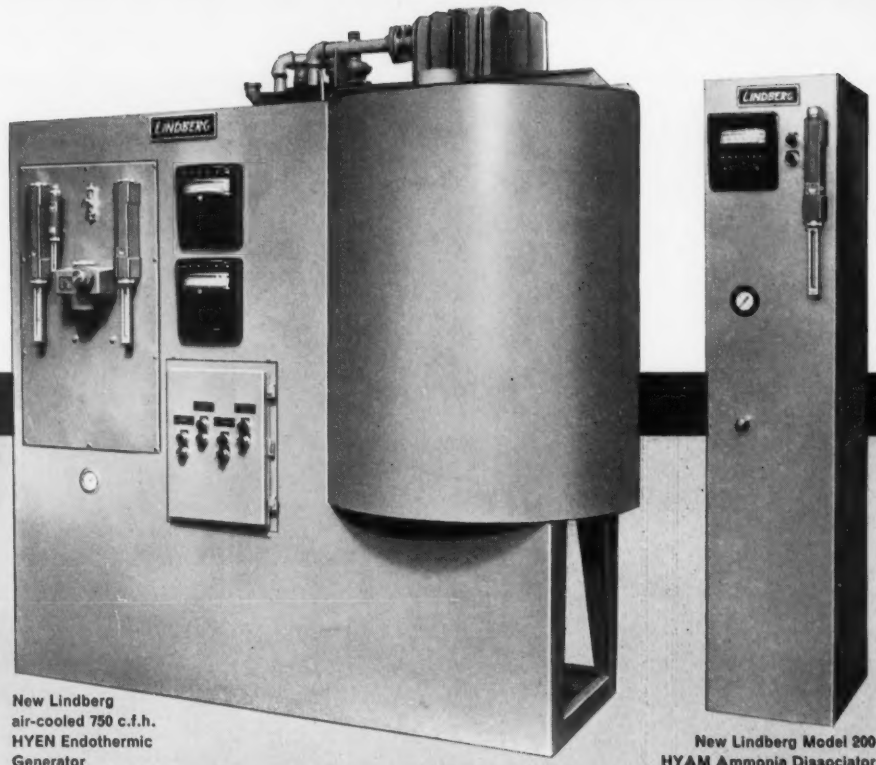


HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

For further information circle No. 4

There's one sure way

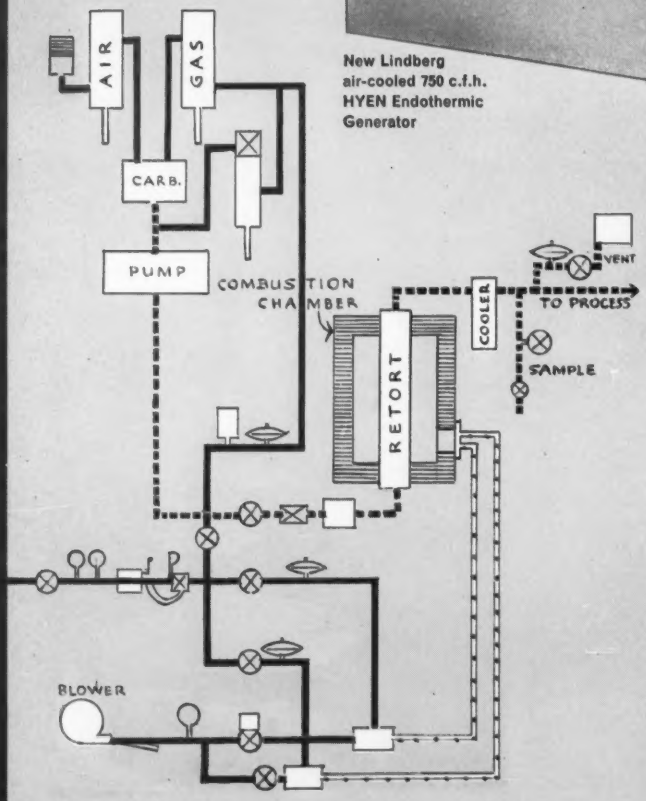
You'll see these brand-new Lindberg Generators at the Metal Show



New Lindberg air-cooled 750 c.f.h. HYEN Endothermic Generator

New Lindberg Model 200 HYAM Ammonia Dissociator

Schematic Flow Diagram of Lindberg HYEN Generator



To be shown for the first time are two Lindberg generators designed and engineered for improved efficiency and economy in the production of metallurgical atmospheres.

The new Lindberg HYEN ENDOTHERMIC GENERATOR is a fully automatic process for producing low cost protective atmospheres for bright hardening, bright annealing or bright brazing of steel totally free from decarburization or carburization. It will provide significant production economies, more precise operation and lowered maintenance costs. This new unit is *air-cooled*, eliminating the expense and trouble of water cooling systems. The HYEN Generator is available in 200, 500, 750, 1000 and 1500 c.f.h. capacities and larger sizes can be provided if desired.

The Lindberg HYAM AMMONIA DISSOCIATOR, Model 200, is a brand-new development offering a combination of efficiency, capacity and compactness never before available to industry. The unit requires *less than 2 square feet of floor space.* Operating at capacities up to 200 c.f.h., it is *guaranteed* to maintain or exceed 99.95% dissociation efficiency (at 150 c.f.h. 99.99% efficiency is guaranteed). It is particularly designed for pilot plant applications, research and development, where high purity of atmosphere is required.

LINDBERG
heat for industry

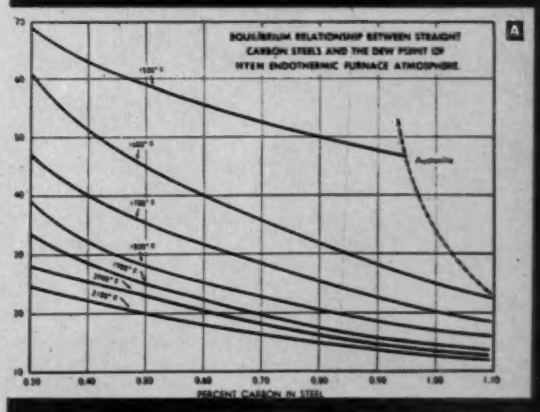
For further information circle No. 5

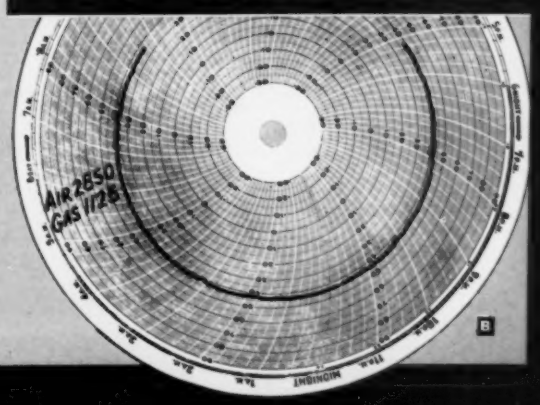
to get the right information on methods and equipment for producing and controlling

metallurgical atmospheres

Lindberg Carbotrol available for either dew-point or CO_2 infra-red control systems

A—Dew point equilibrium curves for use with Carbotrol have been established by Lindberg for types of steel and temperatures involved. B—Typical graph of Carbotrol performance. Note consistency of control.


A
EQUILIBRIUM RELATIONSHIP BETWEEN STRAIGHT CARBON STEELS AND THE DEW POINT OF NITEN ENDOTHERMIC FURNACE ATMOSPHERE
Austenite
PERCENT CARBON IN STEEL



Talk it over with Lindberg in Booth No. 706 at the Metal Show

Because of the importance of metallurgical atmospheres in metal working we are giving the subject major emphasis in our exhibit at the Metal Show. Visit us there and you'll be able to learn about all the latest developments in methods and equipment for producing and controlling these atmospheres. You'll find us well qualified to offer authoritative advice in this field because we've pioneered in it.

In equipment, the first endothermic atmosphere generator was developed by Lindberg many years ago. Through the years generators for varied types of metal treating atmospheres have been developed, including units for exothermic, dissociated ammonia and inert atmospheres. And we have kept adding refinements and improvements to set continually higher standards of efficient and economical performance.

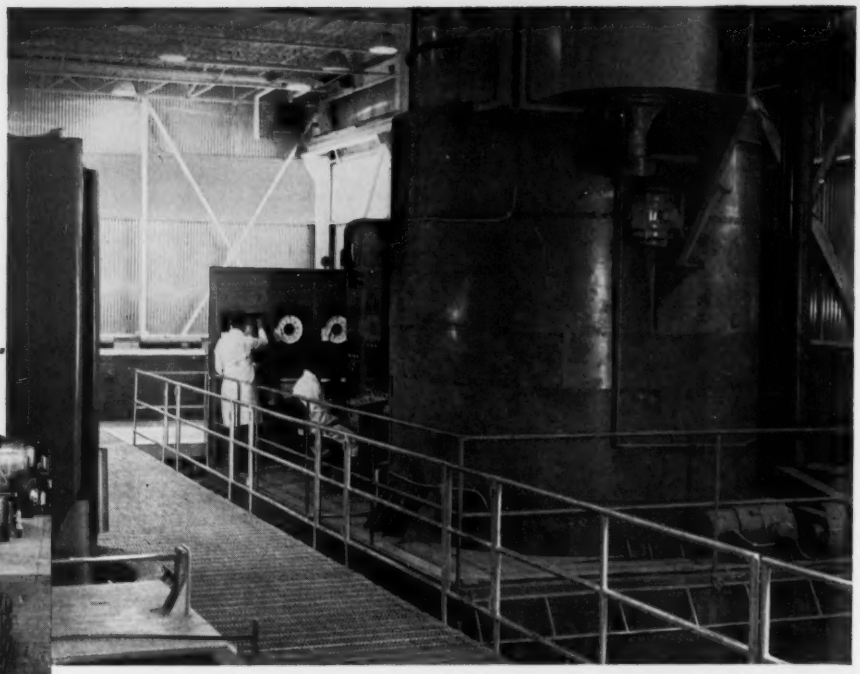
Years ago, too, Lindberg designed the first equipment for controlling metallurgical atmospheres, the Lindberg Carbotrol. For this, Lindberg research also created dew point equilibrium curves to establish proper atmosphere values for types of steel and temperatures involved. The Carbotrol automatically controls these values. It is also available incorporating the new CO_2 infra-red system of control. Since Lindberg makes both types we are in an ideal position to recommend the method most suitable for your specific processes.

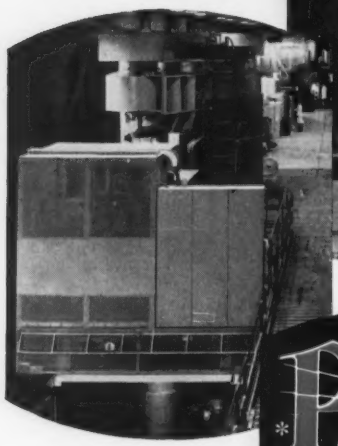
When you visit us at the Show you'll also be able to get the latest information on Lindberg's complete line of heat treating equipment, everything from a laboratory furnace no bigger than a breadbox to a gantry type installation six stories high.

If you don't get to see us at the Show you can get full information on all Lindberg equipment from your local Lindberg Field Engineer (see your classified phone book) or write us direct. Gas Process Division, Lindberg Engineering Company, 2466 West Hubbard Street, Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, Spain, Switzerland and West Germany.

At The Marquardt Corporation's Ogden Division . .





this NEW

DUAL RANGE GANTRY FURNACE

heat treats both aluminum and steel alloys

Now in operation at the Marquardt Corporation's Ogden facility, this giant Pacific Gantry Furnace provides dual heat ranges to permit heat-treating aluminum or steel alloys. Conversion from steel to aluminum treating takes a minimum of 4 hours.

Inside working diameter of the furnace is 72" with a depth of 120". Operation is automatic—the furnace operator on the gantry platform is seated at a control console as the furnace, mounted on tracks, moves over the quench tanks.

When heat-treating aluminum, temperature uniformity is held to ±5°F. in a temperature range of 250°F. to 1400°F. A temperature range of 1200°F. to 2000°F. is used for the steel alloys with a uniformity of ±15°F. This excellent uniformity is achieved with three zones of control using saturable reactors.

When set up for aluminum alloys the furnace may be used for Marquardt parts where large cylinders and cones can be solution-treated and water-quenched. Steel alloys to be heat-treated include large rings of AISI 4340, 310 Stainless Steel cylinders and various types of Die Steels.

This Pacific Gantry Furnace at Marquardt is one of a number of unusual, special purpose furnaces Pacific Scientific has custom-designed and built for the aircraft and missile industry—that produce savings in materials handling time as well as first-cost and maintenance.

Whatever your needs, a Pacific engineer will be glad to discuss them with you. Write or call today!

Pacific ®TRADE MARK

GAS OR ELECTRIC INDUSTRIAL HEAT TREATING EQUIPMENT

Creative Development and Manufacturing in Furnace Design

PACIFIC SCIENTIFIC COMPANY

LOS ANGELES
SAN FRANCISCO
SEATTLE
PORTLAND, OREGON
ARLINGTON, TEXAS
SAN DIEGO
DENVER

PACIFIC SCIENTIFIC COMPANY, P.O. Box 22019, Los Angeles 22, Calif.

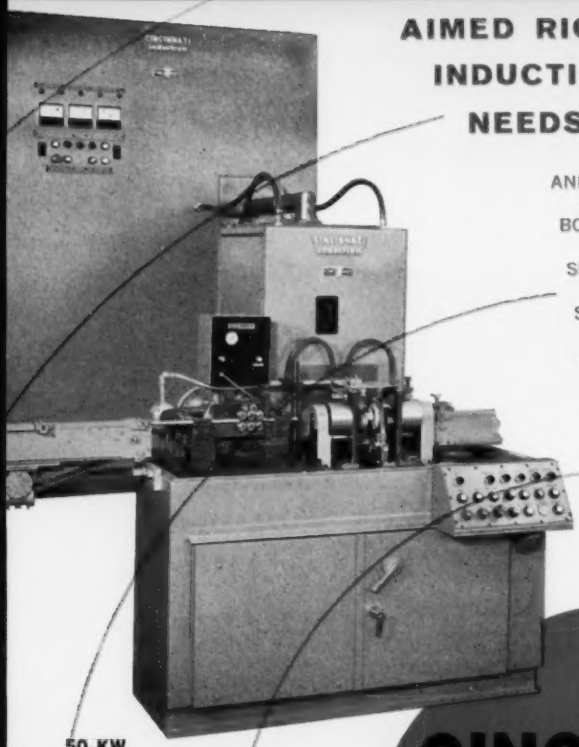
☐ Please send me information on custom designed furnaces.
☐ Please send me your FREE Brazing Catalog.
☐ Please send me a copy of your new catalog and full information on Pacific Heat Treating Equipment.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

For further information circle No. 6

AIMED RIGHT AT YOUR INDUCTION HEATING NEEDS...

ANNEALING
BOMBARDING
SELECTIVE HARDENING
SOLDERING
STRESS RELIEVING
BRAZING
SHRINK FITTING
BONDING



50 KW
CINCINNATI RF Inductron
450 KC frequency
Variable output transformer. Ideally suited for high speed production line operations with power station remotely located and compact work station positioned in the line.

15 KW, 30 KW
CINCINNATI RF Inductron
450 KC/1.2 MC frequencies
For automated, high production heating as well as short run work. Stepless RF output can be varied under load from 30% to 100% of machine rating.

CINCINNATI RF Inductrons IN 7 POWER SIZES

1 KW
CINCINNATI RF Inductron
450 KC frequency
Low cost, portable machine. Performs a variety of heating for manufacturing and assembling of electronic components, small instruments, jewelry.

2½, 5, 7½ KW
CINCINNATI RF Inductron
450 KC frequency.
Completely self-contained and easy-to-move unit for economical assembly line or small lot heating applications. Single or dual heating stations.

Benefit from CINCINNATI Advanced Heat Engineering!

Cincinnati RF Inductron® design gives you extremely rapid heating with positive control, plus long component life and ease of maintenance. Combined with skillfully applied work handling systems, these versatile, trouble-free Inductron machines will bring your heating operations to peak efficiency. Write us, or call a Meta-Dynamics application engineer for a detailed analysis of your requirements.

For further information circle No. 3

META-DYNAMICS DIVISION
Center of Advanced Heat Engineering
Flame and Induction Heating Machines

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio

LESTER F. SPENCER

SPECIAL REPORT

METAL TREATING INSTITUTE ACHIEVEMENT AWARD

ONE OF THE highlights of the four day Annual Fall Meeting of the Metal Treating Institute, which will be held at the Sheraton-Cadillac Hotel in Detroit October 25-28, will be the presentation of the MTI Achievement Award to Lester F. Spencer, metallurgical consultant in the Milwaukee area.

This award is presented to the author of an outstanding lecture presented at the Annual Fall or Spring Meetings of the Institute or to the author of an outstanding feature article appearing in the Institute's national trade magazine, METAL TREATING.

This year's winner, Lester Spencer, will receive the Award for his article published in the June-July 1960 issue of METAL TREATING entitled "Isothermal Heat Treatment-Transformational Behavior in Steels." The Award consists of a cash honorarium and an engraved plaque. It will be presented to Spencer on Thursday morning, October 26 at Cobo Hall during the presentation of the MTI-ASM Joint Heat Treating Session of the Metal Congress.

Spencer, at the time of publication of the article, was technical consultant to the Nuclear Pump Department of Allis Chalmers Manufacturing Company, Milwaukee, and at the present time is a metallurgical consultant in the Milwaukee area. He was born in Milwaukee, graduated from Marquette University with a degree of Bachelor of Science in Chemical Engineering, and received his Master's degree from the University of Wisconsin in Metallurgical Engineering.

Prior to his positions of Research Metallurgist and Technical Consultant for Allis Chalmers Manufacturing Co. from 1955 to 1960, Spencer was chief metallurgist at Diebold, Inc., Canton, Ohio, from 1940 to 1944; chief metallurgist at Landers Frary & Clark, New Britain, Connecticut, from 1944 to 1953; and research metallurgist at the Naval Research Laboratory in Washington, D. C. from 1954 to 1955.

Spencer has submitted and published a number of technical papers since 1944.

He is a member of the American Society for Metals, American Welding Society and the Wisconsin Professional Engineering Society. Lester is married and has three children. He lives in New Berlin, Wisconsin.

How to braze 28 parts of one assembly at one time

The objects shown above are the individual parts and the final brazed assembly of a solid copper, vapor-cooled anode used in a 400 kw continuous output triode. It's produced by the Machlett Laboratories, Springdale, Conn. There are 28 parts in all and the assembled unit weighs 85 lbs. A total of 51 areas and 20 feet of surface must be brazed in one operation. Strong, uniform, vacuum-tight joints are essential.

A Harper pusher-type box furnace equipped with vertical GLOBAR® silicon carbide electric heating elements does the job. Brazing is done in a hydrogen atmosphere protected by purging chambers using nitrogen and hydrogen. Operation is continuous—24 hours a day.

GLOBAR elements make possible the precise control—at 2200 F—necessary for this critical operation. They offer the advantage of clean heat, independent of the atmosphere. The rod type elements simplify furnace design. Maintenance requirements are small—furnace refractory has been changed only once in 4 years, indicating the mild conditions to which brick is subjected with this type of heating. Heat loss is so low that working areas are located immediately adjacent to the furnace.

Why not investigate the advantages of GLOBAR electric heating for your brazing or heat-treating job? Consult your furnace builder or write to Refractories Division, Globar Plant, Dept. MT-101, The Carborundum Co., Niagara Falls, N. Y.

For precise, economical electric heating

GLOBAR
silicon carbide heating elements

- Shipped from stock or within two weeks.
- Temperatures from 1400 to 2800 F, precisely controlled, independent of atmosphere.
- Easily replaced from outside without waiting for furnace to cool.
- "On line" operation for many applications—no transformer necessary.
- Elements 4" to 105" in length.
- For greater economy in heat treating, brazing, forging, melting and sintering.

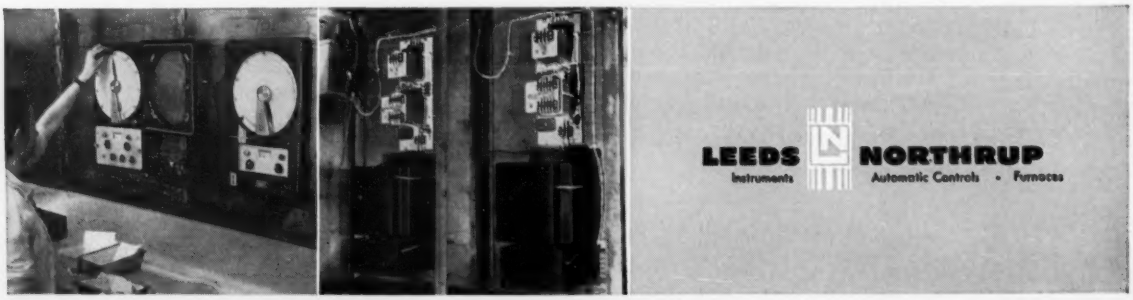
CARBORUNDUM®

For further information circle No. 8

Fansteel Metallurgical Corp.: Operator loads sintering furnace with trays of FASTELL® heavy duty electrical contacts.

Critical sintering temperatures a problem?

Not at Fansteel Metallurgical Corp., where Speedomax® H is regulating moly heaters and simplifying control of critical sintering temperatures. With temperature dependent upon load density and compact composition, Fansteel depends upon experience for the right temperature . . . upon Speedomax H for control reproducibility. Rugged, compact and completely reliable, this controller continuously regulates power input to moly heaters . . . holds furnace temperature well within specified limits. Speedomax H is providing the same dependable control on numerous heat treat processes . . . is helping produce both process economies and a quality product. *Whatever your heat treat, it'll pay you to investigate Speedomax H!* For details, contact your nearest L&N office or write 4999 Stenton Ave., Phila. 44, Pa.



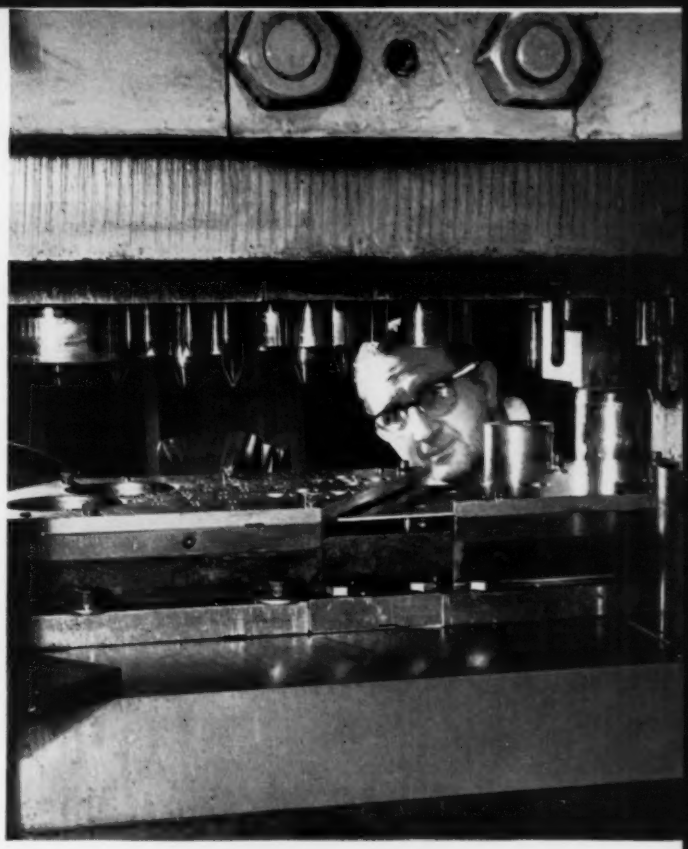
"H" C.A.T. control brings furnace from 900 to 1300 C in 16 minutes without overshoot or hunting. Magnetic amplifiers are conveniently mounted on panel back.

Tool Steel Topics

BETHLEHEM STEEL

Another report on Air-4 tool steel

Blanking and embossing this automotive part, from coiled steel of .125 in. thickness and doing it at substantial speed, is all in a day's work for Bethlehem Air-4 tool steel . . . at Melrath Metal Stamping Corp., Red Hill, Pa. Tool engineers at this plant have several good reasons for giving a good report on Air-4: they like the ease with which it can be machined . . . its simple heat-treatment, and above all, they admire its wear-resistance. Hardened to Rockwell C-60, the die undergoes slight redressing every 100,000 strokes of the press.



HARDENS AT LOW TEMPERATURE

Air-4 is a free-machining, medium alloy tool steel which hardens in air—at about 1550 F. It has excellent free-machining characteristics because of a lead addition. It also has excellent wear-resistance and high toughness, and is deep-hardening to assure long tool life.

Air-4 is a versatile tool steel. Why not place an order right now for a trial bar, and use it in an experimental run? Your Bethlehem tool steel distributor can give you prompt delivery.

Bethlehem Tool Steel Engineer Says:

Always Heat-Treat the Tool Instead of the Thermocouple

Many tool failures can be attributed to the use of improper temperatures during heat-treatment. In many instances, although the thermocouple chart may have indicated proper heat-treatment temperatures, the microstructure of the tool shows that the recorded temperatures were not attained by the tool. This is called "heat-treating the thermocouple, instead of the tool."

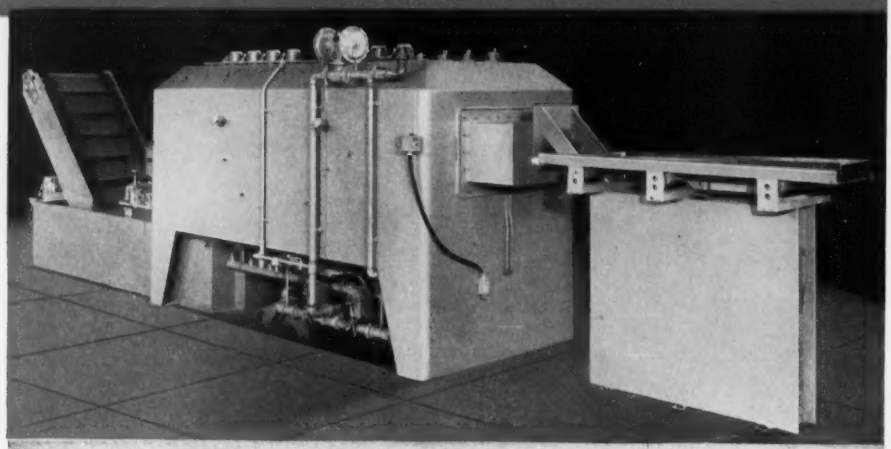
It is easy to see why such errors occur, for the thermocouple indicates the temperature at the location of its tip only. Most furnaces have some non-uniformity of temperature. For example, locations near the source of heat are hotter than remote locations. And the bottom tends to be colder than the top. An operator who is on the ball will survey his furnaces to determine what temperature differences are present. This will assist him in selecting the location which will provide the most accurate indication of the temperature of tools heated in each furnace. It will often indicate that more than one thermocouple is needed.

Where a temperature survey is not feasible, the tip of the thermocouple should be placed as near the tools as possible. But avoid locations near the floor, sides, roof, or near the source of heat. Although the thermocouple is accurate, and highly useful, it's by no means foolproof.

For further information circle No. 70

new Ipsen shaker-hearth furnace with

100% forced convection heating



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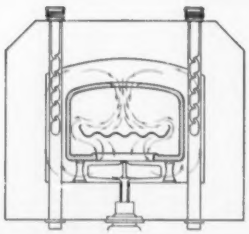

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EF

Wire Mesh Belt Furnaces

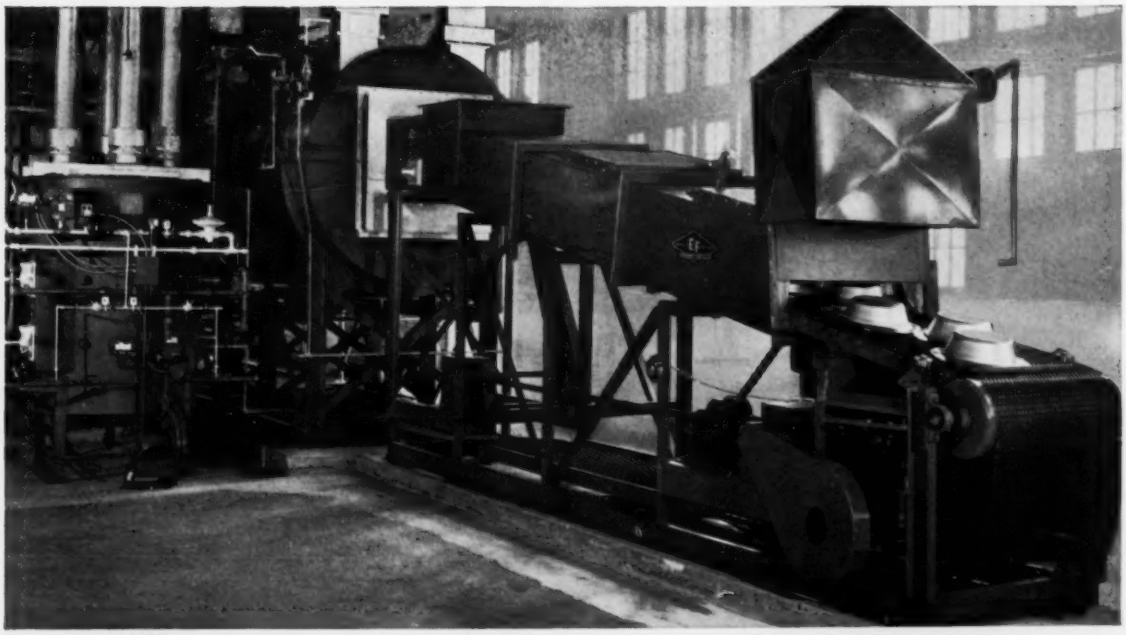
for bright annealing stainless steel and alloy stampings; also sintering, brazing and other heat treating operations.

The EF fuel fired, muffle tube, hump type wire mesh belt furnace pictured below bright anneals 500 pounds of large nickel-chrome alloy stampings per hour at 2150°F in a dissociated ammonia atmosphere. The heat resisting alloy muffle tube protects the materials from contamination by the products of combustion, and the inclined or hump design helps to contain the special atmosphere.

Horizontal straight-through, muffle tube, wire mesh belt furnaces are widely used for sintering ferrous and non-ferrous metal powder products, copper brazing, brass brazing, silver soldering, fluxless copper brazing of stainless alloys, and similar operations.

EF radiant tube fuel fired or electrically heated furnaces, of either hump or straight-through design, can often be used in these services without requiring a muffle.

Call the EF engineers on *every* heat treating problem. Our long experience and extensive research and development facilities can save you both time and money.



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Evaporation Rates of Several Alloys

IN VACUUM AT HIGH TEMPERATURE

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Materials Laboratories
Westinghouse Electric Corporation
East Pittsburgh, Pennsylvania

The evaporation rates of several high temperature alloys at 1 micron pressure and temperatures in the range of 850-1250 degrees C. were determined to evaluate these alloys for application as vacuum furnace components. These alloys exhibited steady rates of evaporation after five to 10 hours of testing. Initial changes in these properties were caused by rapid depletion of the most volatile components from the surface.

THE EVAPORATION rates of metals and alloys ascend with increasing temperature and decreasing pressure. As a rule, the evaporation rates of metals are not significant even at high temperatures; however, in the selection of materials for use in high temperature vacuum furnaces, this property is of extreme importance.

Some designs of vacuum heat treating furnaces utilize internal electrical heating elements and radiation shields. These components must exhibit low evaporation rates at the operating temperature and pressure; otherwise, operational difficulties will occur from build-up of the deposits on cold surfaces such as insulators. Frequent replacement of parts will be required. The refractory metals such as molybdenum, tungsten, tantalum and columbium are probably the only satisfactory metals for high vacuum operations at temperatures above 1000-1200 C. Less expensive metals or alloys are probably suitable for lower temperatures.

The vapor pressures of most pure metals have been determined over a wide range of temperatures.[1] Some of these data are reproduced in Fig. 1. With these data, the evaporation rate which would occur under the anticipated operating conditions can be calculated for pure metals. Unfortunately, vapor pressures of most alloys have not been reported, and they cannot be accurately calculated from the vapor pressures of pure metals. The measurement of the evaporation rates of several commercial high temperature alloys was needed in order to determine the temperature range in which they would be suitable for high vacuum operations.

Test Procedure

Most commercial high temperature alloys are based on combinations of iron, nickel, cobalt, chromium and molybdenum. Since it was not possible to evaluate all available materials, five alloys were selected which would cover the typical base compositions presently available in most high temperature alloys, with the exception of cobalt. These materials were Nichrome V, Hipernik, Chromax, Hastelloy B, and Hastelloy X alloys. (Hipernik is a Westinghouse trademark.) All of these materials are presently used in commercial heat treating furnaces as heater elements or structural components.

Samples of 0.10 by 1.0 in. strip of each of the five alloys were obtained and cut to 3½ in. lengths. This

[1] Duchman, S., "Vacuum Techniques," John Wyley & Sons, 1949, p. 746.

size was selected in order that they be similar to the heater elements used in actual heat treating furnaces, eliminating the need for size corrections.

The samples were heated at various temperatures in the range of 850-1250 C. in a chamber containing a pressure of 1.0 micron. Tests were performed for periods of time ranging from two to 32 hours. Each sample was weighed before and after the operation and the weight loss was calculated from the values obtained. To ensure reliability, most of the tests were made in duplicate or triplicate.

The vacuum chamber consisted of a large glass bell jar approximately 18 in. in diameter and 30 in. high. The vacuum was obtained by first pumping out the system to 200 microns with a mechanical pump and then reducing the pressure to 1.0 micron with a diffusion pump. The pressure was controlled at 1.0 micron by adjustments of a valve located between the vacuum chamber and the diffusion pump. The pressure was measured with a hot filament ionization gage.

The samples were supported on a refractory boat and placed inside a clear silica glass tube. High frequency voltage applied to an induction coil surrounding the tube heated the samples to the proper temperature. The temperature was easily controlled by adjusting the voltage applied to the induction coil. Temperature measurements were made with both an optical pyrometer and a thermocouple.

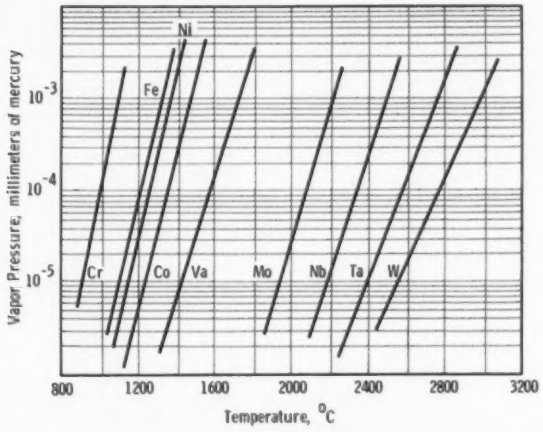


FIG. 1. Vapor pressure of pure metals versus temperature.

In addition to determining the weight loss of the samples, some of the vapor deposits were collected and chemically analyzed. Changes of resistivity of some of the Hipernik samples were also determined.

Test Results

Curves of weight loss in two hours versus temperature at 1.0 micron pressure were plotted for each of the five materials tested. (Fig. 2). Where duplicate tests were made, the results were averaged prior to

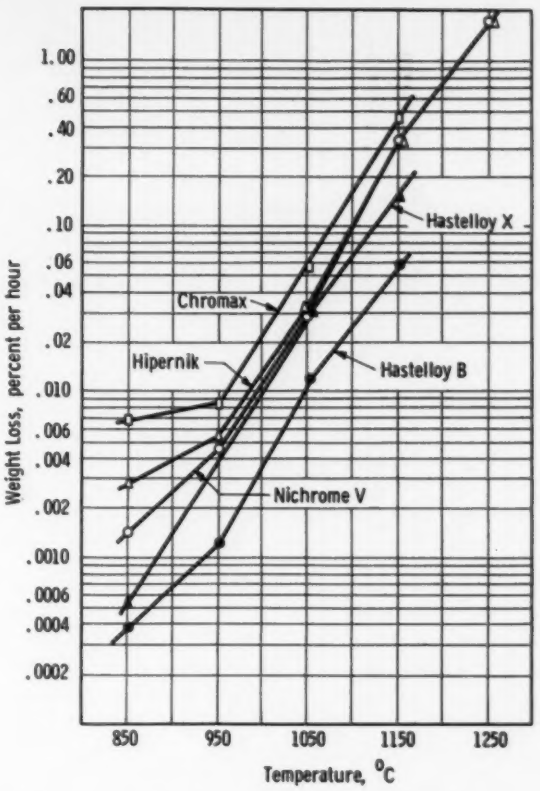
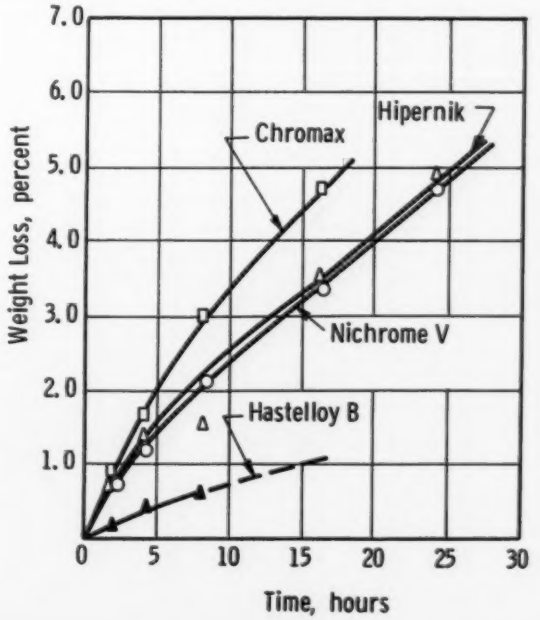


FIG. 2. Weight loss of strip samples tested for two hours at 1.0 micron pressure versus temperature.

FIG. 3. Weight loss from evaporation versus time at 950 C. and 1.0 micron pressure.



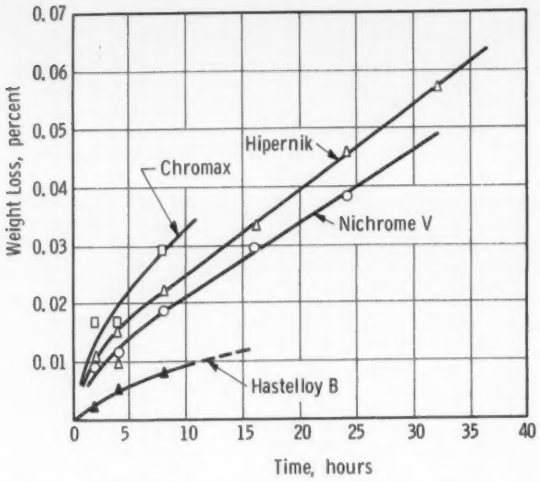


FIG. 4. Weight loss from evaporation versus time at 1150 C. and 1.0 micron pressure.

plotting. In addition, the weight losses at 950 and 1150 C. exhibited by four of the five alloys were plotted to show the relationship of weight loss and the time at temperature (Figs. 3 and 4). The changes of resistivity of the Hipernik samples were also plotted. These curves appear in Fig. 5.

The curves in Figs. 3 and 4 show a relatively rapid weight loss during the first five to 10 hours of operation. After this period of time, the evaporation rate reaches a steady state. A similar relationship exists between resistivity and time at temperature. Rapid change in resistivity occurs during the first five to 10 hours of the test. Thereafter, the resistivity continues to change but it does so at a much slower and steadier rate.

The data obtained from the chemical analyses of the vapor deposits are compared to the nominal compositions of the alloys in Table I. It is evident that the most volatile elements in the pure state are also the most volatile in the alloys tested.

Discussion

The curves in Fig. 2 show increasing weight loss with increasing temperature, and the function, logarithm of weight loss versus temperature, appears linear above 950 C. The weight losses exhibited by Nichrome V and Hipernik alloys are approximately the same, especially above 950 C. The weight loss of Chromax, however, is considerably greater, while the weight loss of Hastelloy X and Hastelloy B are both less than exhibited by the Hipernik alloy.

The changes in slopes of the curves at about five to 10 hours in Figs. 3, 4, and 5, are indicative of a change of composition at the surface of the samples after exposure to the high temperature and high vacuum conditions. It was found the most volatile elements

Concluded on page 42

TABLE I

	Nominal Composition of Alloys				Compositions of Vapor Deposited During 2 Hours at 1150 C.			
	% Ni	% Fe	% Cr	% Mo	% Ni	% Fe	% Cr	% Mo
Hipernik	50	50	....	....	30	68	....	....
Nichrome V	80	....	20	....	46	....	51	....
Chromax	35	45	20	....	14	43	40	....
Hastelloy B	63	5	....	28	86	11	....	0.1
Hastelloy X	51	18	21	10	——Not Tested——			

FIG. 5. Room temperature resistivity of Hipernik strip versus time at temperature at 1.0 micron pressure.

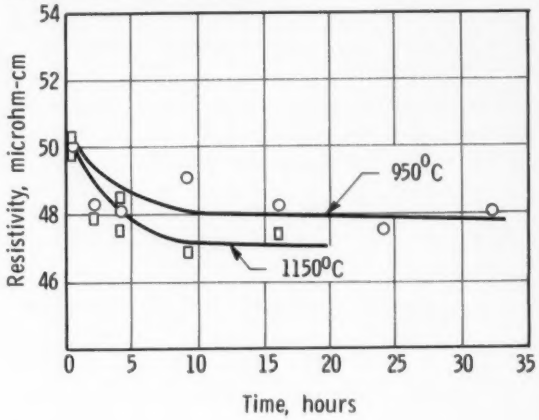
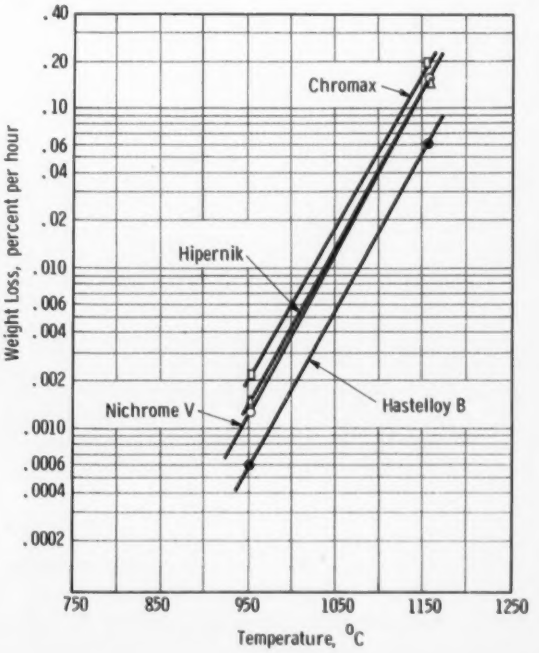


FIG. 6. Weight loss versus temperature at 1.0 micron pressure after 10 hours at temperature.



Modern Industrial Communication

CASE REPORT

E. N. ARNOLD
Radio and Communications Engineer
The Timken Roller Bearing Company
Canton, Ohio

IN A RAPIDLY CHANGING AND HIGHLY COMPETITIVE FIELD, modern industrial communication means more than just the exchange of information. Industry is making increasing use of electronics in the control of production processes for goods and services. Through the use of telephone, radio, intercom systems and even television, better and more efficient production methods are possible.

The Timken Roller Bearing Company, Canton, Ohio, is an example of how large manufacturing firms are improving operating efficiency through electronics.

The Timken Company is one of the largest producers of tapered roller bearings. It also manufactures removable rock bits and produces alloy steel and seamless steel tubing. The size and complexity of the firm's operations, coupled with the most rigid quality standards, necessitates an effective program of control of operations.

One of the most fascinating uses of electronics made by the Timken Company is its closed circuit television systems which guard the tube mill conditioning furnaces. Each system has a television camera and television monitor. The cameras serve not only to prevent product accidents within the furnaces but also provide for better utilization of manpower within the plant.

Installed in 1951 by members of the Timken Company's plant service group, five individual closed circuit television systems are employed in the Canton and Gambrinus tube mills. Each camera is mounted in a water cooled case with a water cooled lens system (Fig. 1). This arrangement provides a view of the 2000 F. interiors of tube heating or annealing furnaces. Cameras are mounted outside the furnace with the lens flush against an opening in the furnace wall. Pictures from the camera are transmitted by coaxial cable to the control pulpit operator more than 100 yards away (Figs. 2 and 3).

Tubes rolling into the charging end of the furnace automatically are moved through the furnace by the walking beam principle. This is a reheat furnace which equalizes the heat prior to reducing the outside diameter of the tube. Any pile up of tubes or misalignment could result in extensive damage to the furnace structure if not observed in time. If crooked, a tube can be laid between the furnace wall and roller, damaging the walking beam. With the TV camera showing the positions of tubes inside the furnace, the operator can quickly stop their movement and have the pile up or cocked tube corrected by men on the floor.

In the hot anneal furnace used to cool tubes at a controlled rate after hot sizing operations, a TV camera is used to position the tubes as they roll into the furnace so even stacks of from two to six, depending on the tube's outside diameter, can be advanced through the furnace for annealing purposes.

The same control room operator watches both fur-

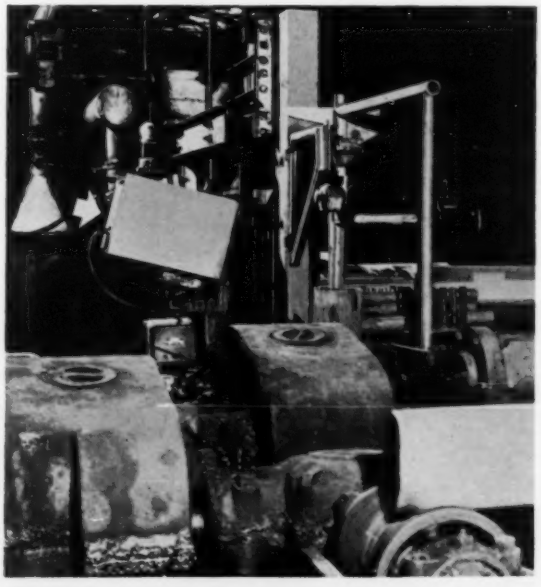


FIG. 1. Charging end of the hot anneal furnace where tubes are charged into the unit. The television camera is mounted on the left side of the furnace.

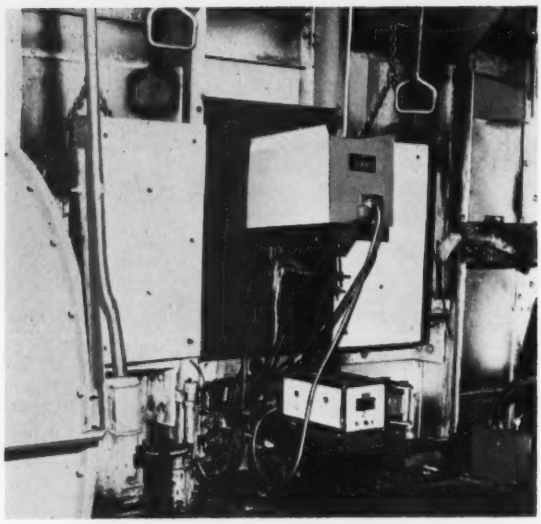


FIG. 2. Camera is shown in position on the walking beam furnace. Insulated doors at each side of the camera are pushed back out of position to show the camera. Normally, these doors are closed on the sides of the camera for added protection from heat.

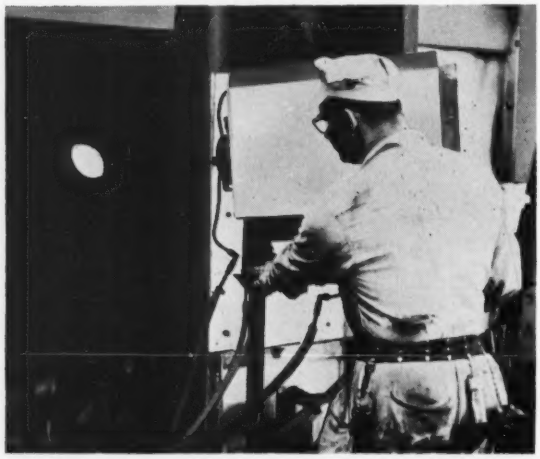


FIG. 3. A maintenance man swivels a camera into position on the walking beam furnace.

naces at once by means of two TV monitors (Fig. 4). Since the control pulpits are small and compact it was necessary for the technicians to devise their own monitors. Most commercial TV monitors available have 10 to 21 in. screens with cabinets exceeding the size of home TV sets. This permits the installation of only one monitor in the control room. In order to provide the operator with two viewer facilities to enable him to watch both operations at the same time, small home type eight in. TV receivers of the portable variety are modified by removal of the RF, IF and sound channels. This makes them strictly video monitors.

Two of these units fit side by side on the control pulpit operating desk. Since the screens are only about four ft. from the operator, the picture is easier to view than if a larger screen were used. Similar setups are used in both the Canton and Gambrinus tube mills.

In addition, another TV camera in the Canton plant watches the loading of a continuous car type furnace with the monitor stationed several hundred ft. away in the control pulpit at the discharge end on the opposite side of the furnace.

The cameras are of the image-dissector type employing a cold cathode. Pickup tube life is in excess of one year of continuous operation and some tubes have been in service over four years. Total maintenance costs for the five systems are very low. The cameras are kept in operation 24 hours a day. The company has found that it gets better tube life from them by around-the-clock operation than would be achieved if they were turned off when not in use.

Cameras are all interchangeable. A spare camera can be used for replacement purposes in any of the five areas. Tubes in the cameras are very sensitive in the infra red region and are ideal for observing operations in the interiors of hot furnaces.

The company's industrial applications of electronics continues to grow rapidly. The amount of electronic equipment involved demands that the company maintain its own service department. This work is entrusted to skilled personnel who make every effort to supply topnotch communication and electronic service. ● ● ●

RIGHT

FIG. 4. Pictured here is a hot bed operator in a control pulpit. The monitor showing the interior of the hot anneal furnace is shown on the left and the monitor for the walking beam furnace is on the right.

STEWART M. DePOY

Consulting Metallurgical Engineer
Cleveland, Ohio

Component Fabrication of Heat Resistant Structures

PRIOR TO WORLD WAR II, almost all furnace accessories were manufactured in the cast form wherein heat resistant alloys were employed. During the war period, however, research and development of stainless and special heat resistant alloys moved forward at an accelerated pace. Modern warfare not only demanded items with heat resistant properties, but also greater ease in manufacturing these items. In the years since World War II, the use of wrought metal has steadily increased and today almost any component that is used at elevated temperatures can be fabricated from sheet, plate, bar or other rolled shapes.

The basic metals in use at present are AISI Types 309, 310, 321, and Trade Alloys RA-330, RA-333, Raonel or Inconel (75 Ni-15 Cr), and Hastelloy X (45 Ni-25 Cr-9 Mo). The nominal chemical composition is shown in table 1. Stress-rupture data are shown in Table 2.

Due to reduction in forging and rolling, the materials have very good directional strength properties and may be formed by all conventional methods. Approximately 50% more power is required on brake dies, rolls, and presses than is required for carbon steel. These materials, although requiring proper skill, may be welded with little difficulty when electrodes are used. They may also be cut by the use of a carbon arc. Newly developed methods in the latter process, e.g., heli-arc and powder, produces shapes that are comparable to torch cut carbon steel parts. They may not be cut with an oxy-acetylene process. Machining is readily performed at speeds and feeds approximately 50% less than those employed on mild steel.

The success of component fabricated structures depends entirely on design and proper forming and joining. Experience in these operations has been gained over the last 15 years by commercial fabricators who have concentrated on heat resistant fabrication only.

TABLE 1. Nominal Composition

Designation*	C	Si	Ni	Cr	Fe	Other Elements
Type 309	.06	.80	13.0	23.0	Rmdr.	
Type 310	.06	.50	20.0	25.0	Rmdr.	
Type 321	.06	.80	10.0	18.0	Rmdr.	
RA-330	.06	1.25	35.0	19.0	Rmdr.	
RA-333	.06	1.25	45.0	25.0	Rmdr.	Co-3.0; W-3.0; Mo-3.0
RAonel	.06	.40	75.0	15.0	Rmdr.	
Hastelloy X	.08	1.25	45.0	25.0	Rmdr.	Mo-9.0

*Type alloys are AISI Specs.-Letter alloys are trade designations.

Proper shapes and sections must be used to achieve maximum results with this type of work. Use of proper bending radiuses and expansion joints is very important. Joining by welding must be performed by an experienced operator who is skilled in this type of work.

It is estimated that 60% or more of premature failures result from improper design and processing. Occasionally the wrong material is specified. However, basically RA-330 should be used for high strength at elevated temperatures. Carburizing atmospheres of .80 carbon potential (below 20 F. dewpoint) cause eventual rupture in all nickel-chrome materials. Use of higher nickel and silicon contents will lengthen working life under these conditions. Consequently, Raonel and Inconel are widely used in carburizing environments. Until the advent of the higher silicon alloy, RA-330, the high nickel grades were used in high carbon potential environments. However, it has been determined in most requirements that RA-330 has equal resistance to carburization and much greater strength and rigidity at elevated temperatures. Through many years, using chiefly trial and error methods, commercial fabricators have developed special additives to their constructions. Fig. 1 illustrates the use of corner gussets and rim expansion joints. In this case alone the life of the tray was extended from one month to one year, a work life increase of 1200%, and a resultant savings of over $2000 per annum. The use of corrugations on the side walls of a structure is highly

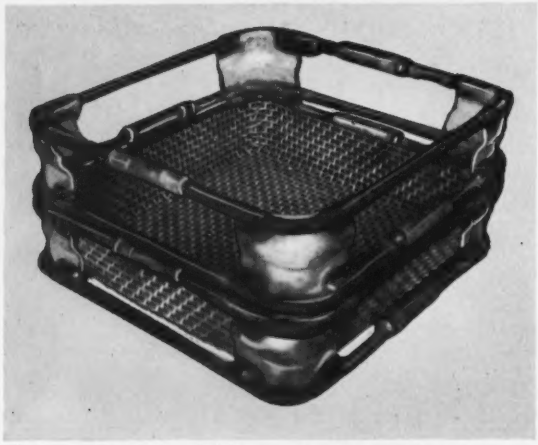


FIG. 1. Basket shows result of use of corner gussets and rim expansion joints.

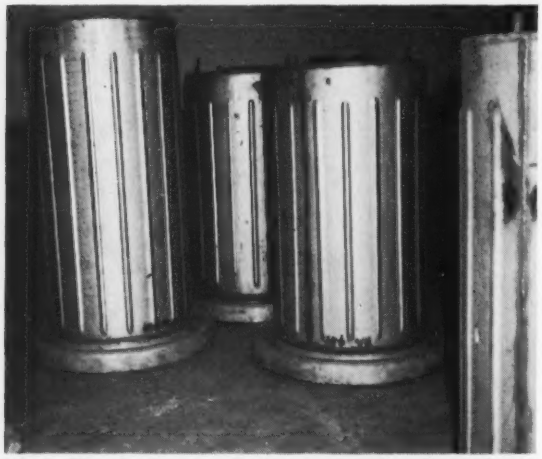


FIG. 2. Through proper corrugation on the sidewalls interference with furnace walls and elements is eliminated.

FIG. 3. Author DePoy recommends the use of corrugations on sidewalls of a structure as shown here.

recommended. This adds strength similar to that obtained by the use of channels and I-beams used in building construction and it provides flexibility for creep and expansion similar to a bellows.

Figs. 2, 3, and 4 illustrate the use of corrugations. The walls hold their original shape under heating and cooling cycles so that interference with furnace walls and elements is eliminated. Fig. 5 illustrates the importance of proper joining. One can readily see that the weld joining the cylinder wall and bell bottom must be perfect or leakage of the molten salt will occur. This was a case of "do-it-yourself" in a commercial heat treating plant, the purpose being to replace a heavy expensive cast pot. Failure occurred at the bottom weld after less than 40 hours of operation. When this pot was built at a commercial fabricator's plant by a skilled welding operator, the weld *never* failed. Failure came from washout at the extreme bottom due to heavy flame impingement. These are only a few of the cases wherein experience and skill have solved the problems of component fabrication.

Why should component fabrications be used instead of castings? As in the case of all contests, each entry has its offensive or credits and each has its debits. An examination of both sides is in order. Most established furnace accessories have patterns available at one or more foundries where the castings can be made as soon as they can be worked into the foundry schedule. However, most commercial fabricators will design, build and deliver the same unit to the customer in the same time interval of perhaps less time than the foundry can produce the item. Obviously, this is because the foundry must rig itself for production operation to make a few parts. This is not true of the fabricator, for he is versatile in his operations, both small and large productive lots.

Next, let us consider the weight and amount of metal used. To cast the retort shown in Fig. 3 it was necessary to use $\frac{5}{8}$ in. to $\frac{3}{4}$ in. walls. The fabricated method employed 3/16 in. walls. This accounts for a saving of 200% in material for the bulk of the unit. Cast sections cannot be made less than $\frac{1}{4}$ in. and only in rare cases can a section be cast in a thickness of less than 3/8 in. Most wrought metal sections are from $\frac{1}{8}$ in to $\frac{1}{4}$ in. and very rarely exceed 5/16 in. on sheet or $\frac{1}{2}$ in. on rods.

With these facts in mind, let us consider the effect of the metal thickness in use. Using the heat treater's

TABLE 2. Stress to Rupture Life in Hours

Material	at 1550 F. Stress—#/sq. in. 1000	2500	5000	at 1650 F. Stress—#/sq. in. 1000	2500	5000	at1900 F. Stress—#/sq. in. 1000	2500	5000
Type 309*	4500	3000	100	3000	600	40	.....	....	....
Type 310*	3000	1500	90	2000	500	30	.....	....	....
Type 321*	3500	1000	100	1000	600	20	.....	....	....
RA-330	5000	4000	300	4000	700	50	2500	35	....
RA-333	5000	5000	750	5000	1000	200	2800	45	....
RAonel	5000	3500	300	2500	500	.....	1000	....	....

*These materials are only recommended for constant elevated temperatures. Premature failure results when they are used for reversing heating and cooling cycles.

"rule of thumb," it would take 40 minutes for heat to penetrate the casting wall before it reaches the work charge, whereas the time necessary to penetrate the wrought metal wall would be less than 12 minutes. Actual heat records show that when the furnace using this retort employed a cast retort the time required to bring a 2000 pound load of steel to heat at 1650 F. was about three hours. After equipping the same furnace with the wrought fabricated retort, the heating time for the same load decreased to 1½ hours. One can readily see the increase in daily production achieved. Using standard cost methods for heating metal, the electric fuel cost for heating a 100 pound cast grid plate to 1500 F. would be about five cents.

A fabricated tray designed to do the same operation would weigh about 40 pounds and the cost to heat it per cycle would be about two cents. Most modern automatic furnaces will cycle four or more trays of this size per hour. This would mean a savings of 12 cents per hour or approximately $720 per year per furnace unit in fuel cost alone.

It must be pointed out that in some cases it is necessary to use the same size sections and weight in a fabrication as is employed in the cast method. If this is necessary, the casting would be more economical in the initial cost. However, the environment in which the structure is used may become a factor, and it would be wise to study this environment and the heating cycle involved.

An important factor in the use of component fabrications is repairability. Welding or straightening a cracked or warped casting is difficult and very seldom accounts for much additional work life. Fabrications are not too difficult to straighten or weld when cracks form or warpage occurs. They may also be patched and sections or components may be removed and replaced by new ones. Finally, the unit cost of the component fabrications is generally at least 15% less than their cast counterpart due to the reduction of the amount of alloy metal required.

In conclusion, let it be understood that it is not the aim of the writer to advise users of heat resistant structures to eliminate castings entirely. On the contrary, some very intricate shapes are produced with much greater ease by the casting method, thus making the initial cost much more attractive. Performance may also be better in some instances. In these cases, it would be unwise to replace the casting with a fabrication. Commercial fabricators actually use castings in their designs and constructions. An example of this is shown in Fig. 6, where the top and bottom ring and the bottom spider are castings. In its proper place, the cast structure is indispensable. However, it is economically wise for users of these accessories to investigate the fabricated method of construction. ● ● ●

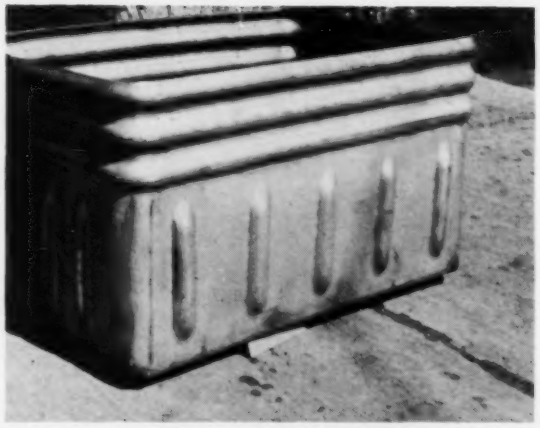
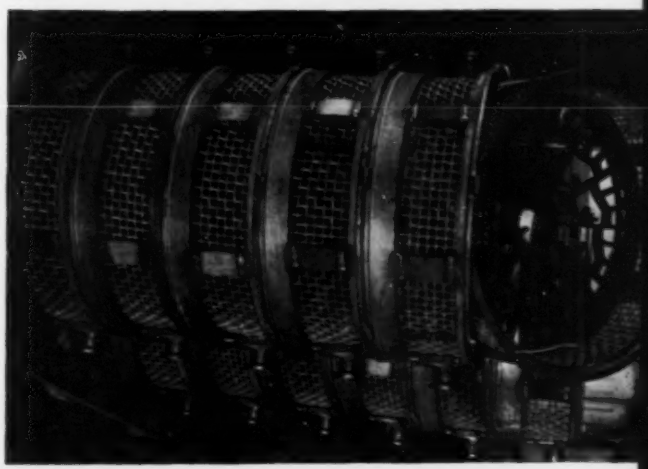


FIG. 4. Side view of basket showing use of corrugations.

FIG. 5. The weld joining the cylinder wall and bell bottom must be perfect or leakage of molten salt will occur.

FIG. 6. An example of castings used in design of a heat resistant structure.



Gratitude and recognition is extended to Hyper Alloys, Inc., of Detroit, Michigan for their assistance in supplying illustrations and much of the technical data contained in this article.

DETROIT, MICHIGAN, OCTOBER 23-27, 1961

METAL SHOW

VISITORS TO THE Detroit Metal Show, October 23-27 in Cobo Hall, will have an opportunity to compare and evaluate the most advanced engineering materials and processes as presented in 275 exhibits and more than 200 technical papers. American Society for Metals, sponsor of the event, has placed more emphasis than ever before on the educational aspects of the Metal Show with the "Materials Application Center" theme.

In the detailed development of the theme center it became apparent that its educational displays would embrace a broader scope than indicated by the original materials comparison terminology. Materials Application Center is believed to be more descriptive of the informative exhibit in store for visitors.

The ASM has encouraged its exhibiting companies to staff their exhibits with engineering experts who are able to demonstrate new processes, answer specific technical questions and help solve the visitor's individual materials problems. The Metal Show, is designed as an educational "short course" for metalworking executives, engineers, production, purchasing and sales personnel.

The Show's educational theme will take shape in the form of a dramatic ASM Materials Application Center, a 12,000 sq. ft. exhibit area that presents seven groups of engineering materials for comparison as to more than six specific properties. Scores of sample parts, components and test specimens will be brought together under the 30 ft. arches of the Metal Show Quadrilon.

Seven pavilions, one for each materials group, will radiate from the Quadrilon like spokes of huge wheels. As visitors proceed through the pavilions, they will see what each materials group has to offer in specific properties categories, as well as compare all the materials groups for specific properties to meet specific requirements. Each pavilion will be roofed with symbolic girders and be color-coded

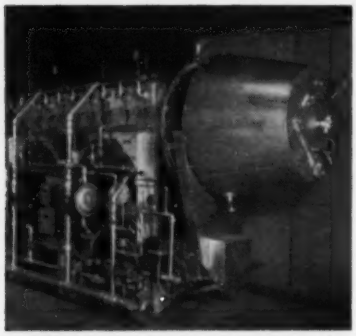
Metal Treating Institute, will, for the first time, have a display devoted to Commercial Heat Treating.

Sixty-two half day technical sessions by a record 10 technical societies and trade associations promise to strengthen the Materials Application Center theme. More than 200 technical papers, panels and special sessions have been programmed by the societies, most of which will take place in meeting rooms adjacent to the exhibits.

Following are short reports on a few of the many exhibitors who will have exhibits at the Show.

American Gas Furnace

American Gas Furnace Company will feature an improved and larger model Automation Furnace with a



production capacity of up to 800 pounds per hour. As is the case with many other exhibitors, trainer personnel will be on hand to describe the principle of operation and advantages of the unit.

Laboratory Equipment Company

Laboratory Equipment Company, St. Joseph, Michigan, will feature its hydrogen analyzer for ferrous and non-ferrous metals and alloys and a pin sampling device. The unit, No. 534-600 has uses for analysis of dissolved hydrogen in such metals as tungsten, titanium, nickel, zirconium, columbium and steel and its alloys, as well as for less refractory, lower melting metals. Laboratory Equipment Company will exhibit in booth 1053.

Pyrometer Instrument Company

Featured at Booth 431 will be the Pyrometer Instrument Company's Pyro Micro-Optical Pyrometer, a disappearing filament type which is accurate to within two degrees C. The Bergenfield, New Jersey firm will display a full line of pyrometers at the Show.

Kolene Corporation

Tufftride will be featured by the Kolene Corporation, Detroit, Michigan, at the show. This molten-salt bath process is applied to mild, stainless, alloy steels and cast iron to produce tough, wear resistant surfaces as well as increasing the fatigue strength of the material. In conjunction with the Tufftride process an X-ray diffraction unit will be employed as a non-destructive quality control medium. In addition Kolene will have visual display facilities for showing and discussing their new molten jet-spray process for descaling stainless steel and the #4 and #5 Kolene processes.

Tempil Corporation

Pyromark will be one of the featured items at the Tempil Corporation display at Cobo Hall. Properties of Pyromark include ease of application, its refractory nature, heat/

shock resistance, adhesion, emissivity and its many colors. The Tempil Corporation, Booth No. 928, also will feature demonstrations of the various applications for Tempilstiks in metal welding and fabrication.

Ashworth Bros., Inc.

Featured at Booth 465 will be Ashworth Brothers, Incorporated's new-

ly marketed flat surface traction drive. The unit has an adjustable belt width up to 36 in. and a speed up to 115 f.p.m. All drive components subject to wear are hardened tool steel and a screw take up permits adjustment to compensate for normal wear.

Merit Products Company

Merit Products Company, Los Angeles, will introduce a new device in the abrasive field for deburring, finishing, smoothing, polishing, etc. at the Show. The company has also refurbished its exhibit to include a demonstration of their Grind-O-Flex and Sand-O-Flex wheels in actual operation to show methods of abrasive operation on stainless steel and exotic metals.

Eclipse Fuel Engineering

The Combustion Division of the Eclipse Fuel Engineering Company of Rockford, Illinois will exhibit at the Detroit Metal Show in Booth 1073. Theme of the Combustion display will be Eclipse Star '60's Products featuring a number of new items of combustion equipment recently developed and released by the company.

Magnaflux Corporation

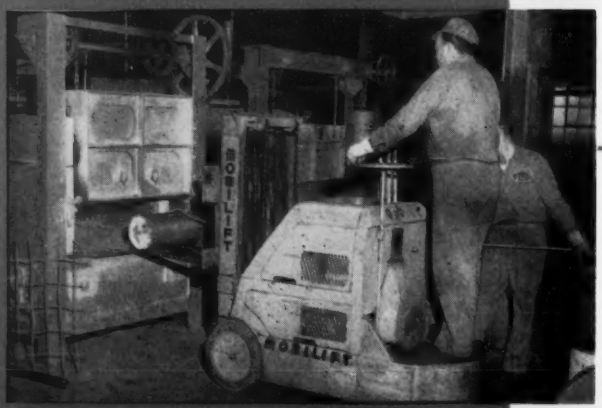
Non-Destructive test systems and equipment will be featured in Magnaflux Corporation's Booth 368 at the Show. Center of attraction will be the Magnatest ED-600, a fixed frequency eddy current instrument designed to locate and determine the relative severity of cracks in non-magnetic metals. Other applications include sorting non-magnetic metals according to conductivity or alloy variation, and thickness measurement of conductive and non-conductive coatings.

Hevi-Duty Electric

A new low frequency induction furnace for melting aluminum and other light alloys will be shown for the first time in the United States

Continued on page 28

Bear in mind—it takes SKILL and EXPERIENCE to Heat Treat Metals . . . Your Commercial Heat Treater provides BOTH



It takes more than equipment, no matter how modern, to perform the complex heat treating processes required today to achieve the property specifications of many metals.

Without the proper combination of operational skill and technical knowledge developed by years of experience, even the most mechanical, up to date equipment can become a menace to your product and a destroyer of your business.

Today the commercial heat treating industry has definitely established its position as the source of skilled, experienced heat treating for all types of metals. Whatever your heat treating problem, always consult your commercial heat treater FIRST.

MTI
MASTER CRAFTSMEN
METAL TREATING INSTITUTE

Write for the booklet "Heat Treating—Should You Do It Yourself"

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

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Columbia Industries, Inc.
6057 State St., Huntington Park
National Heat Treating Co., Inc.
1833 W. Florence, Inglewood 1
Certified Steel Treating Co.
2454 E. 58th St., Los Angeles 58
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood

CONNECTICUT

Commercial Metal Treating, Inc.
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Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 12
Ireland Heat Treating Co.
512 Boston Post Road, Orange

FLORIDA

Rex of Florida, Inc.
1881 S.W. 36th St., Fort Lauderdale

ILLINOIS

Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Allied Metal Treating Corp. of Illinois
333 N. California Ave., Chicago 12
Dura-Hard Steel Treating Co.
2112 W. Rice Street, Chicago 22
Perfection Tool & Metal Heat Treating Co.
1756 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kinzie St., Chicago 22
American Steel Treating Co.
P. O. Box 396, Crystal Lake
Lindberg Steel Treating Co.
1975 N. Ruby St., Melrose Park
Eklund Metal Treating, Inc.
721 Beacon St., Rockford
Ipsenlab of Rockford, Inc.
2125 Kishwaukee Street, Rockford
O. T. Muehlemeyer Heat Treating Co.
1500 Preston St., Rockford
Scott Ford, Inc.
2719 Fifth St., Rock Island

INDIANA

Quality Steel Treating Company
3860 Prospect St., Indianapolis
Industrial Heat Treating & Metallurgical Co., Inc.
2131 Northwestern Ave., Indianapolis 2

MASSACHUSETTS

Kinetics Corporation, a Division of High Vacuum Equipment Corp.
2 Churchill Road, Hingham
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43

MASSACHUSETTS — (Cont'd)

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Springfield Heat Treating Corp.
99 Margaret Street, Springfield
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
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Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Vincent Steel Process
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
Royal Oak Heat Treat, Inc.
21419 Dequindre, Hazel Park
Vac-Hyd Processing Corp.
116 Manchester, Highland Park 3

MISSOURI

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Paulo Products Co.
5711 West Park Ave., St. Louis 10

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Fred Heinzelman & Sons, Inc.
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Spring and Lafayette Sts., Elizabeth
Benedict-Miller, Inc.
Marin Ave. & Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Metal Treating Corp.
107 Vesey St., Newark 5
Temperature Processing Co., Inc.
228 River Road, North Arlington

NEW YORK

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Rural Route 1, Apalachin
Eastern Heat Treating & Brazing Corp.
44 Sea Cliff Avenue, Glen Cove
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E. Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 11
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14

OHIO — (Cont'd)

George H. Porter Steel Treating Co.
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Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

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Robert Wooler Company
Dresher
Wiedemann Machine Co.
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Lorenz & Son
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Metlab Company
1000 E. Mermaid Lane, Philadelphia 18
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TENNESSEE

Mid-South Metal Treating Co.
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TEXAS

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Superior Heat Treating Co., Inc.
P. O. Box 69, Fort Worth 1
United Heat Treating Company
2005 Montgomery Street, Fort Worth 7
Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11
Houston Heat Treating Company, Inc.
2100 Quitman Street, Houston 26
Lone Star Heat Treating Corp.
5212 Clinton Dr., Houston 20

WISCONSIN

Allied Metal Treating Corp.
P. O. Box 612, Milwaukee 1
Heat Treating Engineers, Inc.
1146 North 54th St., Milwaukee 8
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wisconsin Steel Treating & Blasting Co.
1114 South 41st Street, Milwaukee 15
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4210 Douglas Ave., Racine

All of the above listed firms are members of the

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For further information circle No. 13

Metal Show • • •

Continued from page 25

by Hevi-Duty Electric Company in Booth 151. It is one of a new line of induction melting furnaces and receivers that Hevi-Duty is manufacturing in the United States under license from Forni Elettrici A. Tagliaferri, Milan, Italy. Besides the induction furnace, the Hevi-Duty exhibit at the Detroit exposition will include a portable dew point instrument that provides direct readings without conversion, and a tray loaded oven for stress-relieving of metals, core-baking, and many other applications. Both are new products that are being introduced at the Show.

MTI Exhibit

For the first time in its history, the Metal Treating Institute, the national trade association of the commercial heat treating industry, is having an exhibit booth at the Detroit Metal Show. Booth No. 515 will be staffed by the personnel of the seven member companies participating in this cooperative exhibit to promote the use of commercial heat treating services to industry.

Cincinnati Sub-Zero Products

Cooling chambers which through the modification of heavy duty chilling units have been engineered for use

in stabilization and precipitation hardening will be featured at Cincinnati Sub-Zero Products' Booth 1003. The firm's engineering staff will be on hand to demonstrate the equipment and assist in planning a chilling unit suitable for particular applications. Also on display will be a four cu. ft. "V" model which has earned the title "work horse of the industry." The unit is especially designed for moderate production.

Detroit Edison

Detroit Edison, the electric utility which serves Detroit and the eleven county area of southeastern Michigan, has purchased space in the 1961 Metal Show as an information

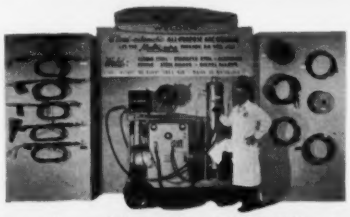
center for those interested in plant location or relocation. Under the major heading, "Southeastern Michigan . . . A great place to be", Edison's display points out the area's advantages with respect to its growing importance as a center for both automotive and non-automotive research and development. Educational facilities and the ready availability of skilled production technologists and managers are also pointed out in the display.

Spencer Turbine Company

Booth 215 will be used for the exhibition of the Spencer Turbine Company's Turbo-Compressor which is used extensively throughout the metal industry for furnishing combustion air for gas and oil fired furnaces. The company, which is based in Hartford, Connecticut, will also exhibit a miniature of a pneumatic conveying system which is used for handling all types of dry free flowing materials.

Hobart Brothers Company

Hobart Brothers Company, Troy, Ohio, will show and demonstrate their new multiple process semi-au-



tomatic welder. The Multi-Wire is a combination welder and matched wire feeder which will utilize all of the new semi-automatic welding processes. A family of welding guns has been developed for each of these processes. When changing from one process to another, it is merely necessary to attach the appropriate gun and cable assembly, and install the appropriate drive rolls and wire guides. Micro-Wire semi-automatic welding of thin gauge metals will also be demonstrated.

Second Annual Symposium

The 2nd Annual Metal Treating Symposium, sponsored by the American Gas Association, will be held in conjunction with and as a part of the overall program of the Metal Show. The Gas Industry's part in the ASM program will take place on Tuesday afternoon in one of the meeting rooms of Cobo Hall, when two papers will be presented which will be of major interest to industrial gas engineers and users of gas for industrial processing operations.

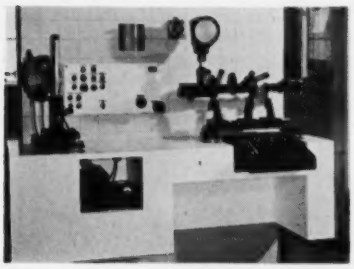
F. J. Stokes Corp.

Two new Stokes vacuum furnaces, an induction heated melting furnace with a capacity of 50 pounds, designed for research and development work or small-quantity production, and a cold wall resistance heated heat treating furnace of medium size, capable of operating at temperatures up to 1650 C. will be exhibited by F. J. Stokes Corporation, Philadelphia, at the Show. Also featured in the Stokes exhibit,

in Space 268, will be the latest addition to the company's line of Microvac rotary mechanical vacuum pumps.

William J. Hacker Co.

Metallographic apparatus designed for classic and new techniques will be shown by William J. Hacker & Company, Inc., in Booth 1020. Instrumentation for wet grinding,



"DP" polishing, electrolytic lap polishing and metal microtomy will be shown. As a new contribution to the field of thermal analysis, an electrically and electronically controlled dilatometer and a new vacuum thermo balance will be on display.

The Sentry Company

The Sentry Company, Foxboro, Massachusetts, will operate a Model "Y" electric furnace of their latest design, demonstrating scale-free, de-

carburization-free hardening on "moly" high speed steel. The equipment used will be similar to that shown here. Metal Show visitors are invited to bring samples of their high speed steel tools for "on the spot" demonstration hardening.

West Instrument Corporation

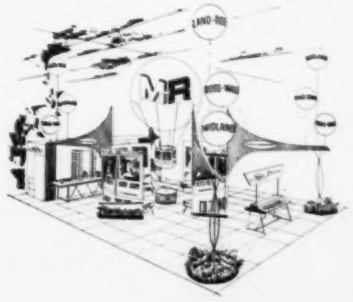
West Instrument Corporation, Chicago, will exhibit for the first time the new Marksman transistorized multi-point stripchart recorder. After years of development and field testing, this dramatic addition to the company's line will be shown with their other indicators, controllers, recorders, thermocouples and pyrometer accessories in Booth 412.

Detroit Hinge Mfg. Co.

Featured for the first time at the Metal Show will be a complete exhibit of Detroit Hinge Manufacturing Company's heavy duty hinges for industry. Included will be heavy duty strap hinges which are primarily designed for heavy oven doors and for swinging doors on heat treat furnaces. The display will be in Booth 1257.

Midland Ross Corporation

Midland-Ross Corporation will feature products of its Surface Combustion Division and Ross-Waldron Divisions at the Show. The Surface and Ross-Waldron Divisions will exhibit a 22 ft. long scaled model,



simulating a 400 ft. line in which strip metal can be annealed and coated in one single, continuous operation. The Midland-Ross display, containing products from three of its 10 divisions, will also feature individual exhibits of steel mill equipment and furnaces built for other heat treating processes. ● ● ●

BOSCH ARMA RELIES ON HARRIS REFRIGERATION TO TRANSFORM AUSTENITE 100%

Fred J. Pasko of Bosch Arma lowers basket of parts to be chill-treated for transformation of retained austenite, into HARRIS Model 10L-A2 production chilling machine.

For 2½ years a HARRIS Model 10L-A2 (10 cu. ft.) Low-Temperature Production Chilling Machine has effectively eliminated retained austenite from critical parts for the American Bosch Division, American Bosch Arma Corporation, Springfield, Mass. The parts treated are fabricated of high nickel carburizing steel and high speed tool steels. All parts have lapped surfaces. "Uniform results" achieved through HARRIS chilling are praised by company officials as the solution to serious problems in dimensional stability formerly resulting from the presence of retained austenite.

ASK HOW LOW-TEMPERATURE CHILLING CAN IMPROVE YOUR PRODUCTS. THERE'S NO OBLIGATION FOR OUR SERVICE.

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WHAT WOULD YOU DO?

a problem in labor arbitration taken from the files of the American Arbitration Association

CASE OF THE MYSTERIOUS TIME CARD

The superintendent of a foundry happened to glance out of his office window one afternoon and noticed one of the coremakers driving off the parking lot. It was still three-quarters of an hour to quitting time, so he assumed the man had asked for and received permission to leave early. But when the time cards for the week came to his desk, he saw that the coremaker's card had been punched a few minutes *after* quitting time. Obviously, someone had done the coremaker a favor at the company's expense.

On examining the other cards, it became apparent that the coremaker's card could have been punched only by one of two men who punched the clock during the same minute. Each of the men denied he was the guilty party, and the coremaker, while admitting he didn't punch his own card, refused to say who did. Under the circumstances, the coremaker was fired and the two suspected men were each given a three day layoff.

The union didn't protest the discharge, but a grievance was filed in behalf of the two employees. "You can't punish an innocent man," said the shop steward.

"Employees have an obligation to the company, and that obligation includes cooperation with management in suppressing dishonesty," answered the industrial relations director. "If the guilty man came forward, the other would not be punished. Under the circumstances, a three day layoff for both is very light punishment."

THE AWARD. The arbitrator agreed that one of the two men deliberately punched out for the coremaker and he added that if the company could prove which one did it, even heavier punishment would have been justified. But he agreed with the union that it was up to the company to prove a case against the guilty person. Since that couldn't be done, the three day suspensions had to be reversed.

CASE OF THE "UNNECESSARY" ASSIGNMENT

When a union and management negotiated a contract at an office equipment manufacturing company, they agreed upon two major provisions intended to protect the jobs of employees. One provided for departmental seniority in case of layoffs and the other obligated the company "to make every effort to find suitable positions for employees injured or disabled on the job."

During the summer of 1960 these two provisions seemed to be in conflict. An employee, who was injured slightly when a casting fell from a shelf onto her hand, was transferred to an easier job, one she could operate while her hand was still in a sling. This forced the displacement of the employee who had been doing that work. The trouble was that the displaced employee had more seniority than the injured one. Naturally, she filed a grievance.

The company's defense was that the job the injured worker was transferred to wasn't really "necessary"; the senior employee would have been laid off anyway. It was all a make-work project to accommodate the disabled employee in accordance with the contract, the personnel manager said.

THE AWARD. The grievance of the senior employee was sustained. The arbitrator said: "There is no controversy over the employer's right to discontinue a part of its operations and to lay off the employees involved. But if the employer decided to continue the operation, even though it may be, in some managerial sense, 'unnecessary,' assignment of employees to the operation must accord with the seniority requirements of the agreement." In short, he said, the company's obligation was to do everything it could to find "suitable positions" for injured employees as long as the seniority provisions were observed.

HARDENING GEAR TEETH for paul bunyan

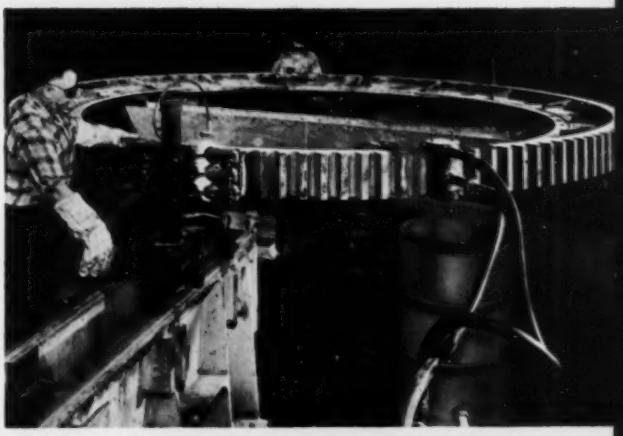


FIG. 1. Typical gear treated in the process described. Made of SAE #1045 steel, it weighs about 15,000 pounds.

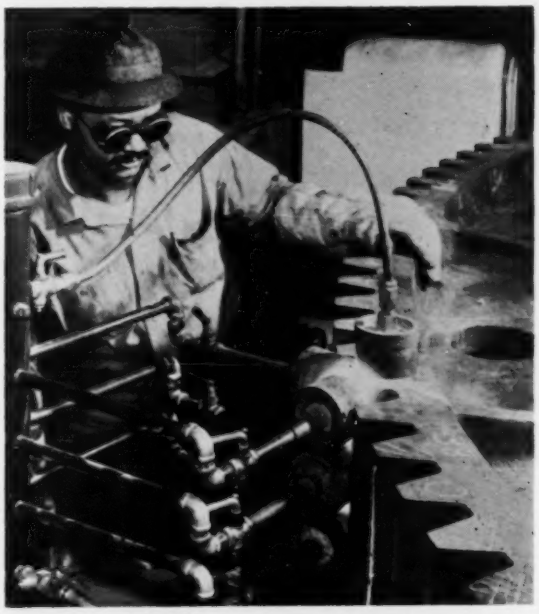


FIG. 2. Large gear being treated. Through this process, each gear tooth is treated under controlled conditions.

THE EARLE GEAR AND MACHINE COMPANY, Philadelphia, Pennsylvania, recently contracted for our services to harden the teeth of several unusually large spur gears for use in the drive-train of large sintering machines. A typical gear (Fig. 1) of SAE #1045 Steel weighs about 15,000 pounds. It is 190 in. diam. by nine in. face, with 142 teeth at ¾ diametrical pitch, and requires heat treatment to impart a hardness of 550 diamond pyramid hardness. This must be accomplished with minimum loss of metal due to scaling, and no decarburization.

For this 190 in. gear, we devised a very simple gradiation heating system. It was basically the same as another facility, designed and built in conjunction with Selas Corporation of America several years ago, for selective hardening of smaller gears and drive-train members.

A rotatable center support platform holds the gear in position and allows the operator to rotate it easily as his work progresses from one tooth to the next. A cluster of eight Selas duradiant gas fired burners, manifolded to our 920 BTU low pressure gas line and mounted on a small rail car that can be moved easily into and away from the gear teeth, directs high intensity heat over the entire gear face, from root to land. Heating and quenching each tooth requires about 15 minutes.

A Selas combustion controller delivers natural gas-air mixture to the duradiant burners at pressures sufficiently high to produce and maintain fast heating rates. It maintains the preselected gas-air ratio and, to a great extent, governs the speed and efficiency of combustion in the mixture. The ability to adjust the ratio also provides the means of supplying to the work a protective atmosphere which is devoid of free oxygen.

The radiant cup burners transfer heat rapidly to the work. This is accomplished by radiation at high thermal gradient, from their highly incandescent ceramic cup surfaces, and by convection of hot gases without flame impingement.

A small hydraulic pump supplies cold water to the portable enclosed quenching head. The head is hung over the heated tooth and is used for quenching.

This system permits selective heating of each gear tooth under controlled conditions. Resulting is a product with uniform hardness and a controlled depth of penetration, with no apparent scaling of the metal surface. Flexibility of the system permits it to accommodate other large sizes of gears. ● ● ●

by

JOSEPH H. BOCKRATH, MANAGER

Heat Treat Department
Wiedmann Machine Company
King of Prussia, Pennsylvania

Heat Treating Case Histories — Case No. 8

About People.....

Lindbergs to Japan For Plant Dedication

Mr. and Mrs. LeRoy A. Lindberg are shown at San Francisco International Airport prior to their departure for Tokyo, the first leg of

a recent Far East tour which included a six week visit to Japan and Hong Kong. Purpose of the visit was the dedication of the new Lindberg Japan Engineering Company, a firm which manufactures industrial metallurgical furnaces.

Mr. Lindberg is president of Lindberg Steel Treating, Inc.

Hutchinson Promoted to Manager of Operations

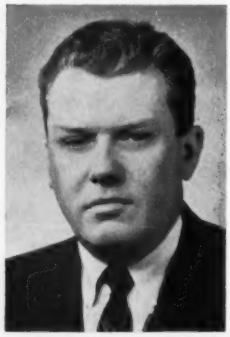
Loren K. Hutchinson has been promoted to manager of operations for the Eastern Division of Wyman-Gordon Company, Worcester, Massachusetts. He formerly was works manager at the Worcester Plant.

In an announcement from Joseph R. Carter, vice president and general manager of the Eastern Division, Hutchinson was made responsible for all manufacturing, product engineering and estimating for both the Worcester Plant and the company's USAF-leased Plant at North Grafton.

Other promotions within the company included the appointment of Arthur H. Swift as director of plant and equipment engineering for the division. He will be responsible for technical direction of major divisional and air force facilities projects, and will approve capital expenditures. He will also investigate new equipment possibilities and processes in the metal working field. Both Hutchinson and Swift will report to Carter.

Hutchinson joined Wyman-Gordon in 1951, as assistant to the executive vice president. In 1953 he was appointed manager of Industrial Relations.

He graduated from Illinois College in 1941 and served in the Navy from 1942 through 1945 as a Lieutenant, and was later promoted to Lieutenant Commander.



Loren K. Hutchinson

He has taken an active part in civic organizations, and is a member of the board of directors and executive committee, Community Chest of Worcester, Inc.; chairman, board of governors, Worcester Junior College, and former president and current board member of the Worcester Orchestral Society.

Polis Will Manage Molecu-Dryer Division

John E. Polis has been advanced to the position of manager of the Molecu-Dryer Division at C. I. Hayes, Inc. In his new capacity, he will be in charge of organizational activities involved in the application and marketing of dryers, purifiers, nitrogen generators, and hydrogen

John E. Polis

generators to the chemical, metallurgical, electronics, petroleum, and other industries involved with the selective adsorption and purification of gases and liquids.

Holder of a B.S. degree in chemistry from the University of Rhode Island, Polis has done graduate work at several technical institutions throughout the country. Prior to joining C. I. Hayes, he was employed as chemical engineer by several major industrial firms.

He is a senior member of both the American Chemical Society and the American Institute of Chemical Engineers, serving as chairman of his section of AICHE.

Pressed Steel V-P Retires After 42 Years

Joseph H. MacVeigh has retired after 42 years with The Pressed Steel Company of Wilkes-Barre, Pennsylvania, where he served for many years as vice-president and general manager of the alloy fabricating firm.

MacVeigh joined the company after an association with the United Gas & Electric Engineering Corp., New York City, where he was industrial gas engineer. He started his

engineering career with the Tennessee Coal, Iron & Railroad Company of Birmingham, Alabama, leaving there to go with the Birmingham Railway, Light & Power Company. When the latter was taken over by United Gas & Electric, he was transferred to its New York office.

MacVeigh resides in Dallas, Pennsylvania.

Ajax Metallurgist

Ajax Magnethermic Corporation, Youngstown, Ohio, has announced the appointment of Clifford Amend

Clifford Amend

as metallurgist. He is a graduate of Carnegie Institute of Technology, Pittsburgh, Pennsylvania, and is a member of the American Society of Metals. For the past several years he has been associated with the Pittsburgh Commercial Heat Treating Company.

Amend will be primarily concerned with heat treating applications and testing of heat treating production units.

Assistant Metallurgist

Roger L. Mogel has been appointed assistant metallurgist in the technical services department of Carpenter Steel Company, Reading, Pennsylvania.

In his new position, he will provide metallurgical counsel and assistance to customers and Carpenter sales representatives. He will also assist in the overall supervision of the company's customer service group.

Mogel joined the metallurgical department as assistant chemist in 1948. He was transferred to the technical services division in 1957. He is a member of the American Society for Metals and the American Chemical Society.

St. Louis Sales Office

A new sales office has been opened in St. Louis by the Scientific and Process Instruments Division of Beckman Instruments, Inc.

Sales engineers appointed to the office are Edward J. Klein and Jack Weir. Klein will be responsible for sales of Beckman's scientific instruments and Weir will handle process instrument sales.

Klein, who holds a Bachelor's Degree in Food Technology from the University of Illinois, formerly was in research with the Quaker Oats Company.

Weir was with Economy Equipment Company, St. Louis, before joining Beckman. He holds a Bachelor's Degree in Engineering, with a major in Industrial Engineering from the University of Southern California.

Hevi-Duty Promotions

Promotion of two sales executives at Hevi-Duty Electric Company, Watertown, Wisconsin, has been announced by general sales manager A. W. Frank.

R. G. Martinek has been named sales manager of the firm's five furnace and oven product lines, a new position created to co-ordinate more effectively the sale, service, and application of these diverse lines. He was formerly manager of special industrial furnace sales, a post he still holds. Martinek joined Hevi-Duty two years ago.

C. A. Newton has become product sales manager of the light industrial furnace line, reporting to Martinek. Formerly an application engineer on this line, he has spent 26 years with the Watertown firm in a variety of sales and engineering functions.

Changes at Basic, Inc.

Changes in the corporate structure and promotions reported from a recent board of directors meeting

Warner B. Bishop

of Basic Incorporated, Cleveland, Ohio, included creation of the office of chairman and chief executive officer. Elected to fill this position

Matthew J. Ludwig

was H. P. Eells, Jr. Succeeding Eells as president is Warner B. Bishop, former vice president in charge of sales.

Howard P. Eells

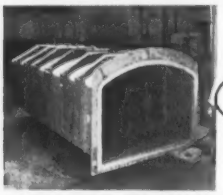
Additions to the company's board of directors were made at a stock holders meeting held prior to the board conclave. Matthew J. Ludwig and Bishop were elected to the board, increasing the number of directors from seven to nine.

Custom FABRICATORS

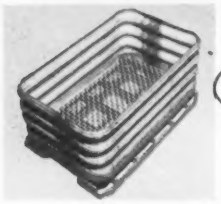
DESIGNERS OF SPECIAL EQUIPMENT

Venturi-High Temperature Alloy

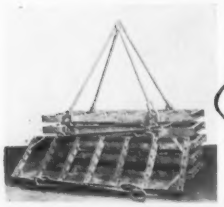
High alloy such as RA-330, Hastelloy and Inconel — for the heat treating industries . . . a plant with over 50 years experience as fabricators, and grey iron castings.



Alloy muffle



Corrugated baskets



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For further information circle No. 15

MacDermid Research Chemist Appointment

Edmund Horner has been appointed research chemist by MacDermid Incorporated, Waterbury, Connecticut. He has been assigned to the research laboratory in the Waterbury plant.

Edmund Horner

Prior to joining MacDermid, Horner was employed by the Oakite Company, first in the technical service department and later in the research department.

He is a graduate of Polytechnic Institute of Brooklyn with a degree in metallurgical engineering and a member of both the American Society for Metals and National Association of Corrosion Engineers.

ACI Re-elects Hagans

As a tribute to his leadership during the past year, J. D. Hagans, sales manager, The Ohio Steel Foundry Company, Springfield, Ohio, was re-elected to the office

J. D. Hagans

of president of the Alloy Casting Instiute at the 31st Annual Meeting of the industry's trade association.

The newly re-elected president, Hagans, has been associated with the Institute since 1943, serving on its Board of Directors three times. Hagans has been with The Ohio Steel Foundry Company since the early 1930's and has held the position of sales manager since 1943.

Elected to the office of vice president was J. W. MacKay, vice president, sales, American Cast Iron Pipe Co., Birmingham, Alabama. He succeeds J. S. Wooters, vice president, General Alloys Company, Boston, Massachusetts. MacKay has previously served on the Institute's Board of Directors.

Schwalm is Holcroft Chief Metallurgist

Donald J. Schwalm, metallurgist at Holcroft & Company, Detroit, Michigan, has been named chief metallurgist for the company, according to an announcement by Walter H. Holcroft, president.

Donald J. Schwalm

Schwalm earned his bachelor's degree in metallurgical engineering from Michigan College of Mining and Technology. A World War II veteran, having served in the United States Navy, he is a member of both the American Society for Metals and the Society of Automotive Engineers.

Wyman-Gordon V-P

Arnold L. Rustay, Shrewsbury, Massachusetts, has been elected a vice president of Wyman-Gordon Company, Worcester. He has been technical director since 1957.

Rustay is widely known in metallurgical circles as an author of technical papers on forging techniques.

NEWS TO HEAT TREATERS...

ASM-MTI Sessions

The Metal Treating Institute will be one of the ten organizations to present technical sessions during the Metal Congress. The ASM-MTI Joint Heat Treating Session will be held on Thursday morning, October 26, at 9:00 A.M. in Cobo Hall. The program will be as follows:

Panel: "Can Your Costs be Reduced by Brazing Techniques?" Moderator: Robert F. Gunow, Vac-Hyd Processing Corp., Detroit. Speakers and subjects:

Don C. Dilley, Ferrotherm Company, Cleveland, "Hydrogen Brazing of Prototype Stainless Steel Fuel Elements for N. S. Savannah;"

Ted H. Crane, Kinetics Corp., Hingham, Massachusetts. "Vacuum Furnace Brazing of Stainless Steels;"

Richard L. Evans, Syracuse Heat Treating Corp., Syracuse, New York. "Furnace Brazing of Steel Parts by Dissociated Ammonia;"

N. K. Koebel and C. H. Ulbrich, Lindberg Engineering Company, Chicago. "Vacuum Brazing of Aircraft Alloys;"

F. J. Fahrendorf, Handy & Harman, New York City. "Salt Bath Brazing of Aluminum;"

R. Seal and D. W. MacVicar, Bi-Braze Corporation, Brooklyn, New York. "Brazing Ferrous Alloys to Aluminum."

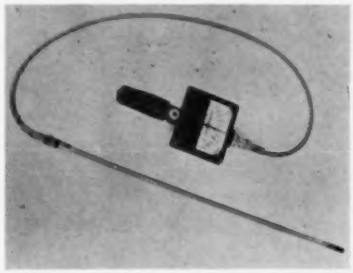
This technical session also begins the three day Annual Fall Meeting of the Institute which will be held at the Sheraton-Cadillac Hotel, October 26-28. The Institute's own technical session will be held Friday morning, October 27, followed by the Fall Meeting Reception and Banquet with dinner music and dancing Friday evening in the Crystal Ballroom of the Sheraton-Cadillac Hotel.

The meeting ends on Saturday, October 28, with the annual Business Meeting and election of officers.

For further information circle No. 16

Portable Potentiometer

Pyrometer Service Company, Inc., North Arlington, New Jersey is offering an unusual portable potentiometer which should prove to be a real contribution to the heat treaters equipment supply.



Invented by the company's president, William E. Engelhard, the unit has been on the market only a short while, but has already proved itself. The following features are provided: one half of one percent accuracy of scale mid point, ranges from 450 to 3200 F. with span of only 250 F. required, automatic reference junction, and shock mounted meter movement.

The unit comes complete with a standard 36 in. and 24 in. thermocouple with protection tube.

For further information circle No. 25

Open New Branch

L-R Metal Treating Corporation, Newark and Elizabeth, New Jersey, has announced the opening of its Middlesex County branch plant at 129 Stelton Road, New Market, New Jersey.

According to company executives, L-R is one of the largest, most diversified metal treating organizations in the country. Included in its facilities are all types of precision heat treating as well as brazing, subzero stabilizing, magnafluxing, consulting metallurgy, metallurgical and quality control laboratory, commercial electroplating and many other services.

The new plant was put into operation in order to give better service to the Somerst-Middlesex-Mercer-Monmouth and Southern Union County areas—and to make available to the industry of these areas a quality heat treating and metal finishing facility.

For further information circle No. 26

Hayes Scanning Device

A new, general purpose scanning device for high production surface hardening of various metals in rod or shaft form is now being offered as a standard accessory for use with h.f. induction generator units manufactured by C. I. Hayes, Inc., Cranston, Rhode Island.

According to Hayes, the new scanning device features automatic speed controls, a spring-loaded centering device for easy mounting of

work pieces, plus air-hydraulic drive for rapid cycling and high production rates. The centers are designed to rotate for even distribution of heat and precise surface heating patterns when the work is lowered through the h.f. heating coil. Centers are adjustable to accommodate various lengths of work, and limit stops permit setting work travel to suit the particular job.

For further information circle No. 27

NEWS TO HEAT TREATERS

Picker X-Ray Formed

A new division to design and produce individualized non-destructive testing systems for industry has been formed by Picker X-Ray Corporation.

Non-destructive testing, which has shown growth and a widening scope since World War II, is credited with saving industry millions of dollars annually by examining products and materials inside and out without destroying or opening them.

Picker X-Ray, a subsidiary of C.I.T. Financial Corporation, is one of the world's largest producers of radiation and other specialized equipment for industry, medicine and science, and produces the widest range of such equipment among U.S. manufacturers. The new division is called Picker Special Products.

For further information circle No. 28

Alloy Supertherm

In a brazing furnace for the thrust chambers of rocket engines at Rocketdyne Division of North American Aviation, Inc., Canoga Park, California, a Supertherm furnace hearth grid assembly is operating at a temperature of 2300 F. The grid is operating in a furnace built by the General Electric Company's industrial furnace division.

It supports engine parts during a brazing cycle of from five to eight hours, with a maximum temperature of 2300 F.

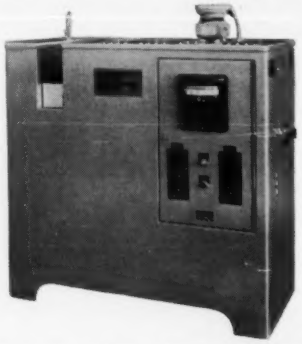
At the extreme 2300 degree temperature, and under severe conditions of thermal fatigue created by the brazing cycle, the Supertherm grid has performed successfully for more than a year.

Supertherm is a new, patented alloy of the Electro-Alloys Division of American Brake Shoe Company, Elyria, Ohio. The alloy was conceived for operation in the high temperature range of 1800 to 2300 degrees.

For further information circle No. 29

New "Shaker" Furnace

A new Model FLA-12 reciprocating furnace featuring push button control for clean, completely



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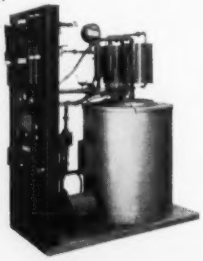
U.S. Patent No. 2,818,246 (Kappel)



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- Complete reversibility and self-cleaning of catalyst beds.
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- Stainless cooling coils prevent reverse action.
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U.S. Patent No. 2,802,725 (Kappel)

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- Same high standards of efficiency and performance as the Endothermic Gas Generator.
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For further information circle No. 18

automatic; and extremely rapid operation has been introduced by C. I. Hayes of Cranston, Rhode Island. The unit is especially designed for low cost high volume bright hardening of very small, slender or fine parts, such as watch parts, ball bearings and equivalent components. Because of the small size of the work in process, these parts are extremely difficult to inspect for hardness. According to Hayes, this new unit practically guarantees 100% acceptable yields, overcoming a troublesome sampling problem.

To operate Model FLA-12 the operator merely presses a button to achieve precise heat up to 1900 F. maximum.

Because of its sealed construction, the Hayes unit maintains atmosphere conditions within very close tolerances.

For further information circle No. 71

Versatile Vacuum Furnace

The Abar Series 90 vacuum furnace designed by Abar Corp., Hotboro, Pennsylvania, is reported to incorporate many new features

which make it versatile for metallurgical research and production sintering. It is designed with special emphasis on ease and efficiency of operation and provision is made for adaptation to future operation requirements. The new furnace operates at up to 4700 F. and at pressures of 1×10^{-6} mm. Hg.

Ease of control and increased operator efficiency result from the following Abar Series 90 features: the height of the top of the furnace allows the operator to stand on the floor and make observations and optical pyrometer readings, the vacuum furnace is so positioned that all instruments and controls are within 18 in. of the operator while he is making pyrometer readings, and all controls and instruments are clearly identified on the illuminated control panel.

In order to provide for greater flexibility in the laboratory, the vacuum furnace is exposed on all sides.

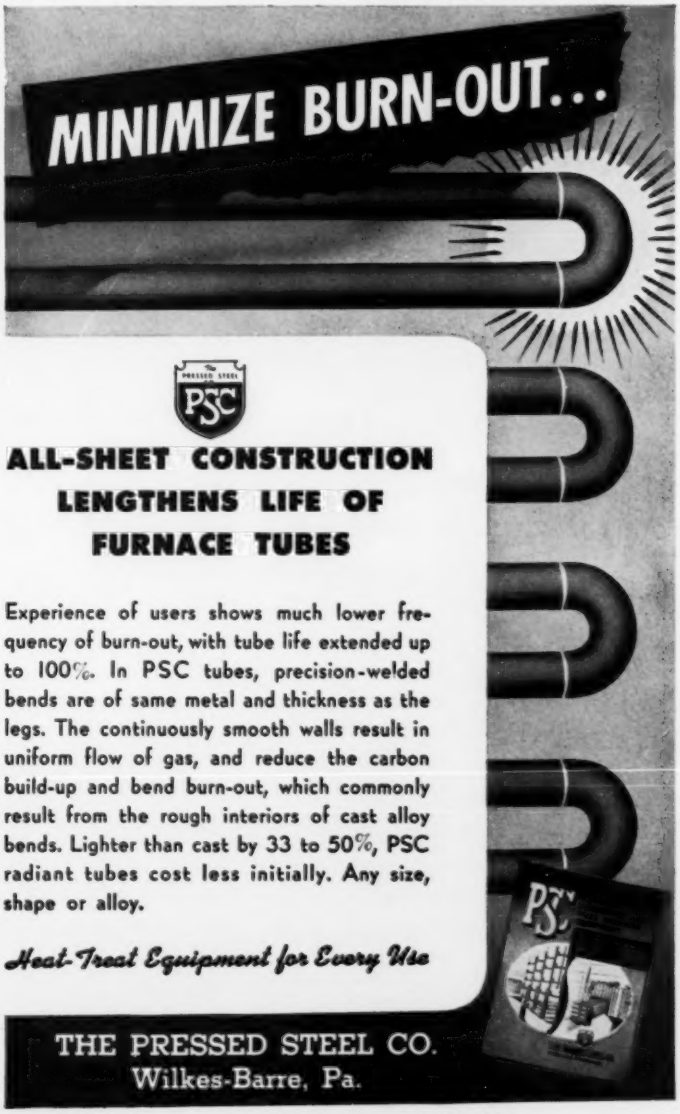
Abar Series 90 vacuum furnaces are available in various combinations of vacuum pumping components, power supplies, hot zone sizes, and heating elements and radiation shields.

For further information circle No. 19

Hot Oil Tanks

D. C. Cooper Company, Chicago, has introduced hot oil bearing expansion tanks in various sizes, designed to handle all size bearings. The tanks are especially designed for heating bearings in oil bath for

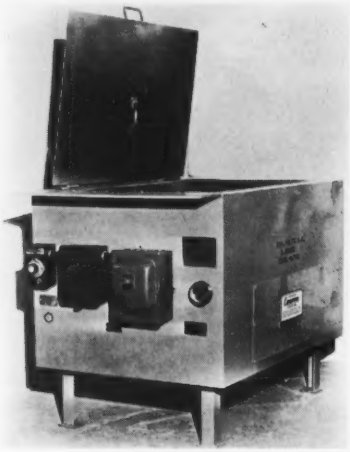
Continued on next page


MINIMIZE BURN-OUT...
PSC
ALL-SHEET CONSTRUCTION
LENGTHENS LIFE OF
FURNACE TUBES
Experience of users shows much lower frequency of burn-out, with tube life extended up to 100%. In PSC tubes, precision-welded bends are of same metal and thickness as the legs. The continuously smooth walls result in uniform flow of gas, and reduce the carbon build-up and bend burn-out, which commonly result from the rough interiors of cast alloy bends. Lighter than cast by 33 to 50%, PSC radiant tubes cost less initially. Any size, shape or alloy.
Heat-Treat Equipment for Every Use
THE PRESSED STEEL CO.
Wilkes-Barre, Pa.

For further information circle No. 20

NEWS TO HEAT TREATERS

easy installation of bearings on journals or shafts. The tanks are electrically heated, thermostatically controlled, with easy reading dial thermometer. They are heavily insulated for economy in operation and comfort of operators.



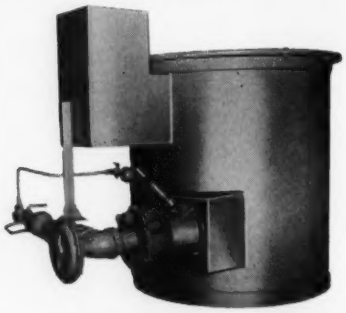
The units meet all requirements of the Underwriters Laboratories for safe, efficient heating of oils.

A removable grid or rack is provided to prevent bearings from resting on the bottom of the tank.

For further information circle No. 72

Warwick Salt Pot

The Warwick Salt Pot Furnace shown here is for economical heat treating using low temperature drawing salts to 1000 F.



The atmospheric burner incorporates a 10-1 turn down ratio. This feature is reported to allow finer temperature control.

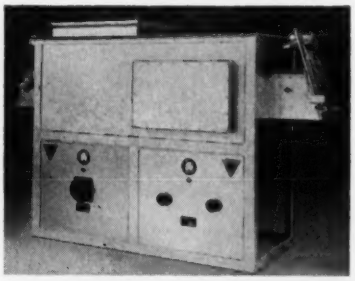
The furnace is fired tangentially for even heat distribution and the rugged construction of the steel shell, with ample insulation and preburned refractory lining, affords sound mechanical support for the pressed steel pot.

The unit is available in sizes for standard pressed steel pots ranging to 29 in. diameter and 36 in. depth.

For further information circle No. 22

Dual Zone Furnace

A unique addition to their previous line of straight line multiple zone electric furnaces is a new dual high temperature, dual zone unit announced by The Pereny Equipment Company, Inc., Columbus, Ohio. Designated Model SNXKSG this unit has two immediately adjacent hot zones; one operating at 2900 F. while the other operates simultaneously at 2300 F. The high temperature zone is heated with molydiscilicide elements and the other with silicon carbide elements.



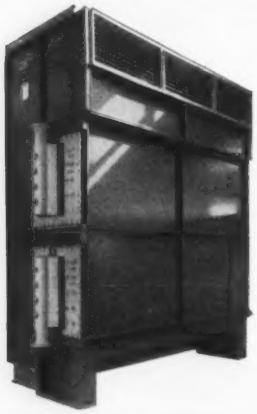
In order to assure necessary temperature gradients and levels, each chamber is controlled by means of its own individual tap transformer and direct reading input ammeter. In addition, each zone is equipped with its own temperature recorder, saturable core reactor and magnetic amplifier to further assure maximum flexibility and control of each chamber.

For further information circle No. 30

Riehle Testing Expands

With the acquisition of two testing machine lines, the Riehle Testing Machines Division of American Machine and Metals, Inc., is expanding its present line of testing machines, instruments and accessories.

(Continued on next page)



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● Use the NIAGARA AERO® HEAT EXCHANGER to control the temperature of your quench bath and you remove the heat *at its rate of input,* always quenching at the exact temperature that will give your product the best physical properties.

The Niagara *Aero* Heat Exchanger transfers the heat to atmospheric air by evaporative cooling. It extends your quenching capacity without using extra water. It pays for itself with water savings.

You can cool and hold accurately the temperature of all fluids, gases, air, water, oils, solutions, chemicals for processes and coolants for mechanical and electrical equipment. You get closed system cooling, free from dirt and scale.

Write for Bulletins 120, 124, 132

NIAGARA BLOWER COMPANY

For further information circle No. 31

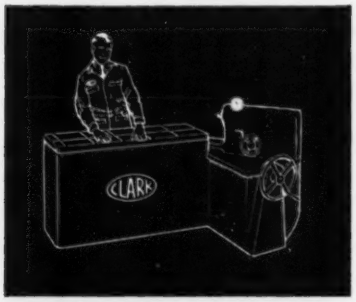
Charles W. Anderson, A.M. & M. president, announced the purchase of Steel City Testing Machines, Inc. of Detroit, Michigan and the hardness tester business of the Torsion Balance Company of Clifton, New Jersey, makers of Kentron and Kentrall hardness testers.

These acquisitions now give Riehle a complete line of portable, bench and floor mounted hardness testers for Vickers, Rockwell and Brinell hardness scales as well as expanding its line of tensile compression, ductility and flexure testing machines.

For further information circle No. 32

Horizontal Tester

A new type horizontal Rockwell hardness testing machine has been developed by Clark Instrument, Inc., Dearborn, Michigan. The new horizontal tester, first of its kind, will insure accurate and efficient testing of large size pieces with ease of loading and operation.



Ideally suited for checking gears, the head swings 180 degrees, allowing accurate checking of the outside, pitch, and root diameters. It can be equipped to check large inside diameters as well. Also, the table size can be tailored to a particular job application.

In many respects this is a universal machine which can be engineered to the customer's exact specifications.

For further information circle No. 23

PROPANE GAS PLANTS
ANHYDROUS AMMONIA PLANTS
Designed and Installed
PEACOCK CORPORATION
Box 268, Westfield, N. J.

For further information circle No. 33

What can you gain by better temperature control?

See us at the Metal Exposition Cobo Hall Detroit, Michigan Oct. 23 thru 27, 1961

If temperature is a factor in *any* step of your overall operation, quality of its control can affect *several* steps far more than you might expect. And, from our experience with countless applications that may be considered "satisfactory," control is rarely as good as it can be...

Temperature control can be more precise and consistent. It *can* reduce work-stoppage and rejects. It *can* increase volume and maintain quality. It *can* simplify some steps and materially cut costs.

Use the know-how of our world-wide service force to evaluate your potential in temperature control. Free consultation plus complete selection of instruments to suit your individual situation—Veri-Tell Indicators, Gardsman Controllers, Marksman Recorders, our own Thermocouples and accessories.

Proportioning Controller

Gardsman Model JP (shown) automatically adjusts On-time to Off-time to maintain any desired temperature within extremely close limits. Wide selection of Gardsman controllers provides for all control applications. All are tubeless, "solid-state" and proved in wide use. Phone your West consultant (see Yellow pages) or write Chicago office for Bulletin JP or for COM digest-catalog of line.

WEST *Instrument* **CORPORATION**
SALES OFFICES IN PRINCIPAL CITIES
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4357AA W. MONTROSE, Chicago 41, Ill.
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WEST INSTRUMENT, LTD.
52 Regent St., Brighton 1, Sussex

the trend is to **WEST**

For further information circle No. 34

NEWS TO HEAT TREATERS

To New Location

In a move calculated to increase both capacity and efficiency, Shea-Brownell Company, St. Louis, has moved to new quarters at University City, Missouri, a suburb of St. Louis.

Shea-Brownell are heat treating engineers and represent, among other companies, Stanwood Corporation, Chicago.

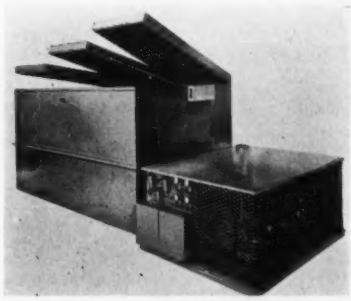
For further information circle No. 24

Recessed Chamber

A recessed chamber designed especially for metallurgical processing of ferrous and non-ferrous aircraft quality materials at minus 110 F. is being marketed by Cincinnati Sub-Zero Products Company.

The stainless steel chamber, which measures 120 in. long, 60 in. wide and 60 in. deep, will chill one half ton of steel from ambient to minus 110 F. in two hours. It has been constructed for continuous operation. Even temperature distribution is accomplished by means of two 16 in. fans which are flush-mounted in the chamber backwall.

Three, full opening, hydraulically operated lids give access to the chamber interior which is divided



by removable mullions. The photograph shows the complete cabinet with individually controlled lids, and the power pack and work surface which, in actual operation, is in line with the chamber top.

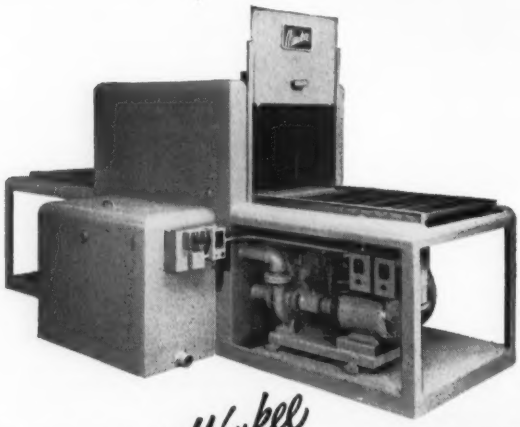
For further information circle No. 35

Semi-Conductor Aid

Solving complex problems has long been a challenge which Wheelco Engineering meets head on—and usually comes up with the correct

answer. Often, the result of such an answer is a new aid to engineering or, as in this case, a new series of aids which the heat treating industry can utilize.

When a large east coast organization asked Wheelco to provide a control center for use in semi-conductor work which is made up of a series of laboratory and production procedures, Wheelco engineers



There's a standard Waukee® WASHER
TO MATCH YOUR CARBONITRIDER OR CARBURIZER!

Whatever the size of your carbonitrider or carburizer, the new Waukee Washer has a standard size to match it. Size range: 24 x 36 x 18 — 24 x 48 x 24 — 30 x 48 x 24 — 36 x 48 x 24.

COMPLETE — NO "EXTRAS" — Waukee parts washers come to you complete, ready to locate, connect to utilities, and begin operation. No "extras" to buy and install. Pumps, burners, controls are designed as integral parts of the Waukee Washer. You use your present furnace work-baskets, too.

FLEXIBILITY — You gain in flexibility with Waukee Washers. Standard units are available in "in-and-out" feed or straight-through, conveyor type, and in one, two, or three stages with rinse and dry. High-efficiency with gas, electricity, or steam.

THOROUGH CLEANING — The smallest Waukee Washer sprays a minimum of *one ton of hot detergent solution through the load each minute*. Solution penetrates work basket from top and bottom, washes away oil and foreign matter from the densest charge. Bull's-eye timer cycles the load for complete washing without guesswork or waste of time.

Complete data in Bulletin 1201 — write for it today.

Waukee-washed parts are free of cutting and quenching oils, mean clean furnace atmospheres, therefore predictable case depths and cleaner, brighter work.

Waukee ENGINEERING CO.

5137 N. 35TH ST., MILWAUKEE 9, WIS.

MAKERS OF WAUKEE GAS FLO-METERS • MIXORS • COMPRESSORS

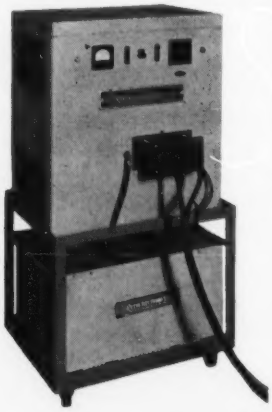
For further information circle No. 36

found that the development of a portable control center, shown here, which incorporated an 8000 Series Multipoint Recorder, a Model 407 Capacitrol and a Model 72000 Chronotrol along with the necessary magnetic amplifiers and saturable reactors, did the job.

For further information circle No. 37

Reevelec Model L6H-P

A new unit reported to be ideally suited for metal heating applications which involve heating of hard to get to areas is available from Reeve



Electronics, Chicago. The unit can be used for various brazing, soldering and heat treating applications.

Reevelec Model L6H-P comes as a complete, integrated machine and is mounted on large casters for easy wheeling from one work area to another.

For further information circle No. 38

ALL
THE BEST
HEAT RESISTING
ALLOYS

FROM STOCK

Stock List and Literature Available

ROLLED ALLOYS, INC.
Heat and Corrosion Resistant Alloy Specialists

5309 CONCORD AVE. DETROIT 11, MICH.
330 WILLIAM ST. SOUTH RIVER, N. J.

For further information circle No. 39

For almost every hardness testing requirement

There's a Wilson "Rockwell" instrument to do the job

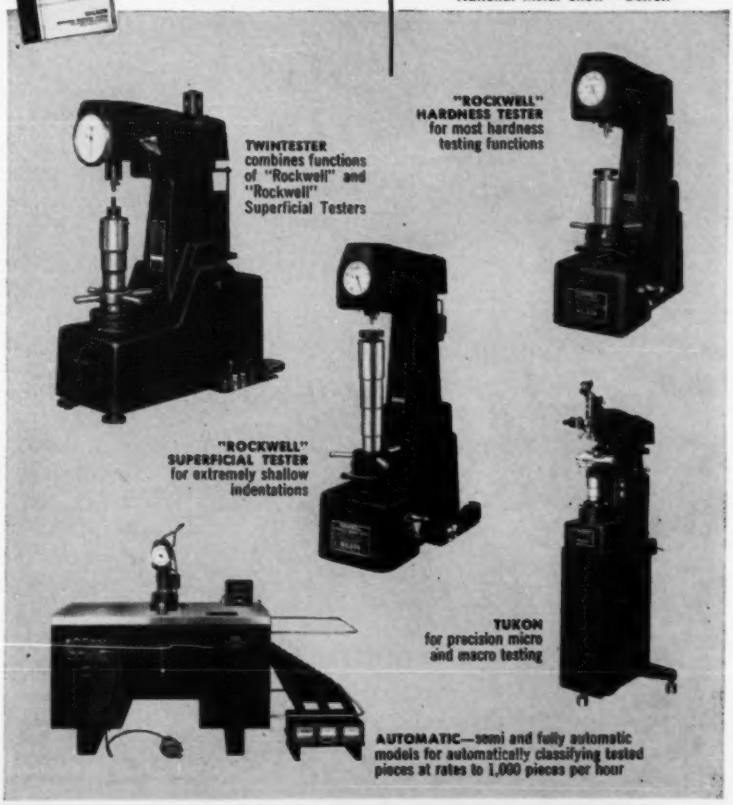
Wilson "Rockwell" Hardness Testers can help make your products better, stronger, longer lasting. They give reliable results on the production line, in laboratories, in tool rooms, and in inspection departments. They're as easy to use as a center punch, as durable as a machine tool, as sensitive and accurate as a precision balance. That's why Wilson "Rockwell" is recognized as the world's standard of hardness testing accuracy.

Wilson "Brale" Diamond Penetrators give Perfect Readings

A perfect diamond penetrator is essential to accurate testing. Only flawless diamonds are used with Wilson "Brale" penetrators. Each diamond is cut to an exact shape. Microscopic inspection and a comparator check of each diamond—one by one—assure you of accurate hardness testing every time.

Write for Catalog RT-60. It gives complete details on the full line of Wilson hardness testing equipment.

See us in Booth 952
National Metal Show — Detroit


TWINTESTER
combines functions of "Rockwell" and "Rockwell" Superficial Testers
"ROCKWELL" HARDNESS TESTER
for most hardness testing functions
"ROCKWELL" SUPERFICIAL TESTER
for extremely shallow indentations
TUKON
for precision micro and macro testing
AUTOMATIC—semi and fully automatic models for automatically classifying tested pieces at rates to 1,000 pieces per hour

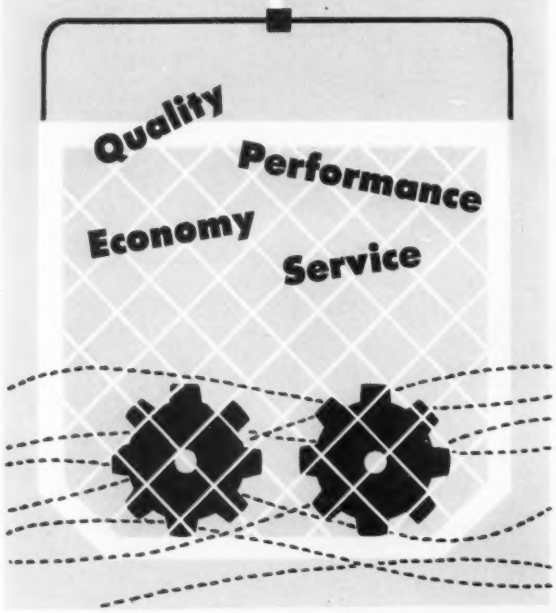
WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-R Park Avenue, New York 17, New York

For further information circle No. 40

HEATBATH SALT BATHS FOR



on all Heat Treating Jobs

CARBURIZING • QUENCHING • ANNEALING • NEUTRAL HARDENING • NITRIDING • BRAZING • TEMPERING • DESCALING • MARTEMPERING • HIGH-SPEED HARDENING

HEATBATH CORPORATION

SPRINGFIELD 1, MASSACHUSETTS

or 701 North Sangamon St., Chicago 22, Ill.

39 Years of Service to the Heat Treating and Metal Finishing Industry

For further information circle No. 41

EVAPORATION RATES • • •

Concluded from page 18

contribute most to the evaporation weight loss of the samples. The rate of subsequent evaporation is controlled by the rate at which the volatile elements diffuse from the center to the surface of the samples, accounting for the steady rate of evaporation after about five to 10 hours.

The curves in Fig. 2 show the relative relationships of the rate of weight loss for only the first two hours at temperature for the five alloys tested. They cannot be used to predict the weight loss for a long period of time. Prediction of long term weight loss should be based upon the steady rate of weight loss exhibited after five to 10 hours of operation.

Steady rates were calculated from the slopes of the curves in Figs. 3 and 4. They are plotted in Fig. 6. These curves, which show the effect of temperature on the steady rate of evaporation of Chromax, Hipernik, Nichrome V, and Hastelloy B alloys are approximately linear, since the deviation from linearity of the curves in Fig. 2 was only slightly above 950 C. The data in Fig. 6 can be used to predict long term evaporation weight loss. These data, when used in conjunction with the data in Table I, provide a basis for the selection of alloys for high temperature, high vacuum operation.

The development of alloys for high temperature operation has usually included consideration of need for oxidation resistance. Therefore, relatively large amounts of chromium were frequently used. Chromium, however, is relatively volatile as shown by the rapid evaporation loss of this element during the tests. The need for oxidation resistance is of little importance in the selection of alloys for vacuum furnace components. Because of this, chromium should be included in only minor amounts. On the other hand, the highly refractory metals are ideal from the standpoint of vapor pressure. These metals can be economically used as major constituents in nickel or cobalt base alloys. The latter two elements can be melted in air. In addition they exhibit considerable solubility for the refractory metals. Nickel and cobalt have vapor pressures which are as low as any other material which can be suitably air melted. Such alloys probably offer the greatest hope for use as economical structural components in vacuum furnaces intended for operation at temperatures in the range 800-1200 C. • • •

American Economic Foundation Report

The need to modernize and eliminate the burden of obsolete machinery and equipment has been described as the greatest problem that "faces the American free enterprise system at this point in its development."

The position was taken by The American Economic Foundation in announcing a reprint of the text of the

United States Treasury Department's Depreciation Survey as an educational service.

Noting that the Treasury Department Survey stands as the most authoritative guide to the needs and thinking of American industry in the field of depreciation policies, the Foundation said:

"No greater problem faces the American free enterprise system at this point in its development than that all segments of industry shall appreciate the need to modernize and eliminate the burden of obsolescent machinery and equipment which handicaps its most efficient operation.

"Two national administrations have now considered problems raised by existing depreciation policies. As long ago as 1944, President Roosevelt and many of his top advisors, including Harry Hopkins and Henry Wallace, recognized the urgent necessity for meeting the problem of obsolescence in American industry and publicly called for depreciation reform.

"The response to the Treasury survey is industry's answer on how the Federal Government can create a climate that should result in faster economic growth, the creation of millions of new job opportunities, stronger national defense, and renewed competition with foreign goods.

"We hope that this publication will stand as a constant reminder that America's capitalistic economy—the most successful and bountiful the world has ever seen—should be nurtured and strengthened."

The statement was contained in a preface signed by Fred G. Clark, general chairman, and Richard S. Rimanoczy, editorial director, of The American Economic Foundation.

The Treasury said in the report, which was released publicly in January 1961, that about 70 per cent of the companies responding to the questionnaire on depreciation policies considered depreciation allowances inadequate because of higher prices for equipment to replace obsolescent and worn out property.

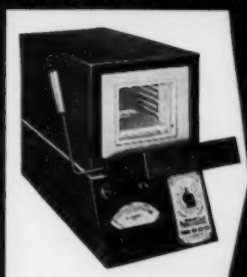
Vacuum Heat Treating

A new flexible vacuum heat treating furnace which makes vacuum heat treating—the heat treating method of tomorrow—available today, has been installed by Benedict-Miller, Inc., Lyndhurst, New Jersey. The unit is reported to make production vacuum heat treating commercially available for the first time to the industries of New York, New Jersey and surrounding areas.

Designed by Ipsen Industries, the unit, which was discussed in the June-July issue of METAL TREATING, features automatic controls and positive safety interlocks, allows parts to be put under vacuum and then heated to the desired temperature at a pre-set rate, and then either slow cooled under vacuum at any desired rate, or fast cooled under a protective gas atmosphere to room temperature.

For further information circle No. 42

Designed for Small Parts Treating . . .



HUPPERT
DeLuxe
ELECTRIC
FURNACES

Write today for literature on complete line of Huppert Furnaces and Ovens in floor and bench models. Ask for "Hints on Heat Treating."

• Here's a series of compact, durable furnaces that are ideal for tool and die shops and small laboratories. Any desired temperature within the range of 250° to 2000° F. is controlled by an accurate, built-in Huppert Temperature Controller. All-steel construction — multi-insulation — sturdy Kanthal elements — counterweighted doors — removable porcelain tray.

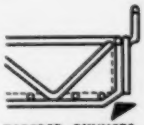
Model No.	Inside Dimensions			Temp. Range	Watts 110 Volts AC	Price
	Wide	High	Deep			
434DL	4¼"	3⅝"	4¾"	325°—1850° F.	920	$ 90.00
439DL	4¼"	3⅝"	9"	325°—1850° F.	1630	120.00
436DL	4⅝"	3¾"	6"	250°—2000° F.	1650	130.00
5DL	4⅝"	3¾"	9"	250°—2000° F.	1750	176.00
9DL	6"	6"	6"	250°—2000° F.	2200	200.00
669DL	6"	6"	9"	250°—2000° F.	3000	248.00
10DL	8"	4"	6"	250°—2000° F.	2000	220.00
849DL	8"	4"	9"	250°—2000° F.	3000	265.00

Available for 220 Volt AC at small additional cost.
Stainless steel housing slightly higher.

K. H. HUPPERT CO.
Manufacturers of Electric Furnaces and Ovens
6849 Cottage Grove Ave. Chicago 37, Illinois

For further information circle No. 43

MOVE IT FASTER
...over any surface!



TAPERED RUNNERS

The New WIRETEX Model B-1 TRAY for pusher and horizontal type furnaces is designed to cut "moving" costs. Tapered runners permit riding over the roughest surface and obstructions freely. Compact! Rugged arc (not pressure welded) welded construction assures a long life under the highest temperatures.

Standard units: 34" long, 22" wide, 6" high. *Other sizes, all metals and alloys available.*

Call WIRETEX for all your heat treating fixtures, and save.

Specialists in Processing Carriers Since 1932.

Wiretex mfg. co., 16 Mason Street, Bridgeport 5, Conn.

For further information circle No. 44

MANUFACTURERS' LITERATURE

For your copy circle the number on the Readers' Service Card

A Special six-page commemorative brochure on the occasion of the company's fiftieth anniversary, has been published by The Cambridge Wire Cloth Company, Cambridge, Maryland. In addition to containing product information on Cambridge Metal-Mesh conveyor belts, industrial wire cloth and wire cloth fabrications and Gripper Metal-Mesh slings, the brochure carries a brief descriptive history of the uses of wire from as far back as 5000 B.C. to the present. Also contained are illustrations of the various manufacturing facilities in the plant at Cambridge, Maryland, special commemorative messages from company executives, and some general information on Maryland's eastern shore, where the company is located.

For further information circle No. 45

Low Temperature Research is just one of many subjects covered in a multi-paged, heavily illustrated brochure available from Harris Manufacturing Company, Cambridge, Massachusetts. Of particular interest are case histories of the successful applications at "blue chip" companies such as Raytheon, Hoover, General Electric, and others.

For further information circle No. 46

A 25 Page Illustrated Handbook on industrial x-ray films marketed by Gevaert Company of America is now available. The booklet contains comparison tables of the five Gevaert structurix industrial x-ray films, technical data and sensitometric curves on each of the five films. The handbook also contains charts showing suggested exposures for magnesium, aluminum, steel and bronze, along with exposure charts for cobalt 60 and iridium 192 with steel. In addition, there is also a selection on processing x-ray films, charts showing film sizes converted to square footages, and a table of common logarithms.

For further information circle No. 47

Safety Marking for plants and equipment is the subject of a new brochure being issued by the Sherwin-Williams Company. Entitled "Colors and Methods," the booklet shows samples of the six generally accepted safety marking colors, and explores in detail their application to the hazards most frequently encountered in industrial plants. The use of paint as a housekeeping aid is also given attention.

One section of the eight page pamphlet is devoted to pipe identification and outlines the American Standards Association recommendations in this area. Successful methods of striping and banding pipes of various sizes are discussed.

For further information circle No. 48

A New Data File, detailing procedures for torch brazing with Silvaloy low temperature silver brazing alloys, has been published by the American Platinum and Silver Division of Engelhard Industries, Inc. of Newark, New Jersey. The literature describes six steps for strong, leak proof joints: joint design, preparation for brazing, fluxing and assembling, heating and making the braze, cooling the work and flux removal, and inspection.

For further information circle No. 49

The Macmillan Company, publishers, have contracted with the Air Force to make available to the general public a monumetal five volume work, *The Handbook of Thermophysical Properties of Solid Materials.* Vital information on twelve major properties of solid materials that melt above 1000 F.—elements, alloys, ceramics, cermets, intermetallics, polymerics, and composites—had been published in various magazines and journals over a period of seventeen years. Nobody predicted at the beginning of this project that it would result in more than one book. But it has taken 4300 pages—not to mention thousands of charts, graphs, and tables—to record the work of Armour's team in collecting, evaluating, and consolidating this important data.

For further information circle No. 50

A New Issue of the *Stanwood Selector* details a representative grouping of items of heat treating equipment. The issue is designed to give the user a quick survey of the broad selection available in the Stanwood line. Illustrated and described are baskets, trays, carburizing boxes, fixtures and furnace parts. New and improved items are also shown, together with a number of specialized fixtures.

For further information circle No. 51

Latest Developments in the fast changing field of tool steels and their application to tools and dies are described and interpreted in the third and completely revised edition

Continued on page 47

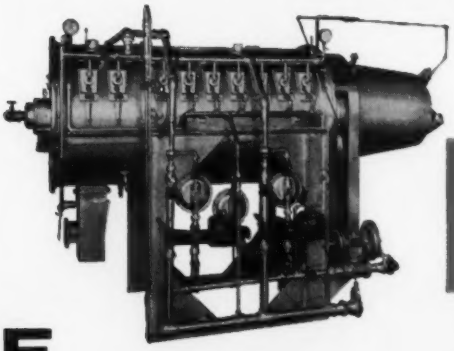
choose the versatile Best...

AGF

AMERICAN GAS FURNACE CO. 83 YEARS OF PIONEERING 1878 1961 ELIZABETH, N. J.

ROTARY RETORT AND RECIPROCATING HEARTH

for all small parts heat treating



AGF

Model 139-MRD

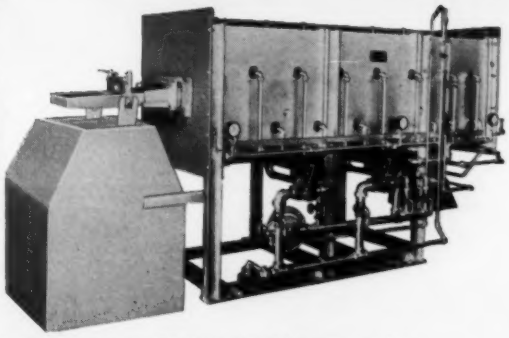
Medium size rotary furnace for the most economical mass treating of parts that can be subjected to a gentle tumbling (approximately ¼ r.p.m.).

Tumbling insures uniform heating and atmosphere contact.

AGF

Model 221

Medium size Shaker Hearth Furnace for the widest range of work, even light and delicate stampings. Momentum imparted to each work piece conveys it individually through the heat with no distortion or warpage.



Capacities to 800 lbs. per hour. Processing pieces from .010" to 1" thickness and up to 10" in length. Automatic continuous feeding reduces direct labor costs drastically! Clean hardening, ammonia-gas case hardening, light case carburizing of steel parts, etc., are accomplished equally well WITHOUT ANY MODIFICATION OF THE FURNACE.

The muffles and retorts are, in reality, radiant tubes WITHIN which the work and atmosphere gas is contained. Zoned combustion systems uniformly heat these muffle tubes from the outside to the desired temperature in each work zone. Control is precise, results uniform.

SEE AGF'S LATEST MODEL 139-MD ROTARY RETORT FURNACE AT THE METAL SHOW EXHIBIT 821

New catalog of entire AGF line of equipment and accessories now available . . . Write for your copy today.

AMERICAN GAS FURNACE CO.

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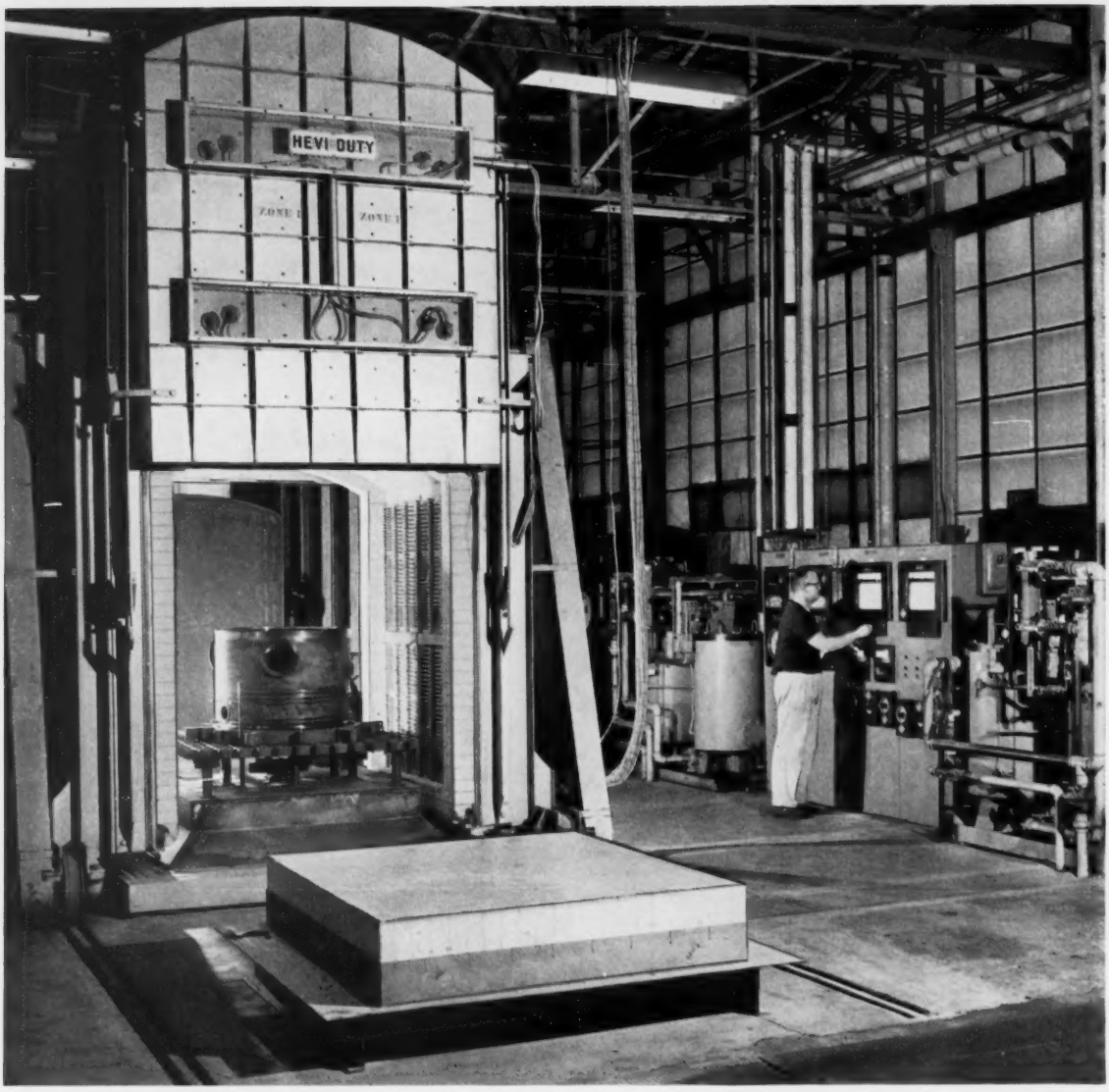
Another example of Hevi-Duty Engineering Ingenuity



Special car bottom furnace moves to the work... solves head room problem, holds ± 10°F accuracy

Tapco Group, Thompson Ramo Wooldrige, Inc., Cleveland, wished to use bell furnaces but lacked necessary head room in the heat-treating area. Hevi-Duty engineered the perfect solution.

A special car bottom furnace was designed. It moves over the load . . . in contrast to the usual car bottom furnace where the load moves into the furnace. Two pedestals are used to permit continuous use of the furnace. Atmosphere-type retorts allow for slow cooling while a second load is being heated in the furnace . . . thus the furnace is used 24 hours a day . . . seven days a week.

Operating in the range of 1200°F, the furnace holds temperature uniformity to ±10°F. Work being tempered or stress relieved in this furnace has actually come out brighter than when it entered.

In more than four years of operation neither this Hevi-Duty car bottom furnace nor a duplicate furnace, installed a short time later, has required replacement of heating elements.

Talk with Hevi-Duty about your next heat-treating project. For information about a full line of electric or fuel-fired industrial furnaces and ovens, call your Hevi-Duty sales representative or write to Hevi-Duty, Watertown, Wisconsin.

H-35-61

HEVI-DUTY

Electric and Fuel-Fired Industrial Furnaces and Ovens

BPC

Hevi-Duty Electric Company, Watertown, Wis.

A Division of Basic Products Corporation

MANUFACTURERS' LITERATURE

Continued from page 44

of *Tool Steel Simplified,* published by The Carpenter Steel Company. This volume, first printed in 1937 and revised in 1948, has again been expanded by the original authors, Frank R. Palmer and George V. Luerssen. Two new chapters have been added to advise the tool and diemaker on hot work steels and air hardening steels—two new groups of tool steels which have greatly increased in importance in recent years. A chapter on high speed steels has been rewritten to fit the almost universal changeover from tungsten high speed steels to the molybdenum types. The 550 page book sells for $2.50 in the United States and $3.00 elsewhere.

For further information circle No. 52

A Buying and Estimating Guide for deep-drawn hollow aluminum bar stock, available in all machining alloys, has been published by Harvey Aluminum, Torrance, California. Quick reference tables in the new brochure give weights, pre-calculated clean up and machining allowances, wall thicknesses, lengths, and mechanical properties. Other sections of the publication concern shop-proven advantages of deep-drawn hollow stock over solid bar stock for machining applications. The brochure replaces a previous edition which covered a more limited range.

For further information circle No. 55

Vacuum Furnaces, a 24 page booklet published by Consolidated Vacuum Corporation, Rochester, New York, gives complete details concerning vacuum metallurgy and the various types of vacuum furnaces and their component parts. Included are vacuum induction heat sintering and heat treating furnaces. Unusually detailed, this booklet would serve as a thorough guide for anyone considering the possible use of vacuum equipment as part of production procedures.

For further information circle No. 56

The Cost of Heat Treating is a new booklet prepared by Pittsburgh Commercial Heat Treating Company to assist companies now doing their own heat treating to establish the cost of treating these parts. The booklet contains work sheets for the computations of all cost involved with maintaining heat treating departments.

For further information circle No. 57

Data Sheet 17 describes Heppenstall T77, a low-carbon, medium-tungsten, hot work steel. Intended for use as forging and extrusion dies and components for the fabrication of brass, it also is suitable for die casting dies for both brass and aluminum base alloys, and for hot trimming applications.

For further information circle No. 58

Unique General Alloys'

WROUGHT-CAST RADIANT TUBES

give consistent long life

General Alloys' combination *Wrought-Cast* Radiant Tube Assemblies give consistent long life because they combine a *cast* return bend with straight tubes made from *rolled and welded plate.*

This design utilizes the erosion resistance of the casting where it is most needed . . . at the return bend. The straight tube sections are fabricated from plate having a uniform wall section. These lightweight, dependable tubes save you fuel and maintenance dollars.

General Alloys Company is unique as a major producer of *both* castings and fabrications and therefore can recommend, without bias, the type of construction best suited for your needs.

For complete data, quotes, or engineering service contact the office nearest you . . . or write General Alloys Company, 390 West First Street, Boston 27, Massachusetts.

Ask about how our tube repair service can save you money!

GENERAL ALLOYS CO.

the only producer of both heat resisting castings and fabrications

QALLOYS

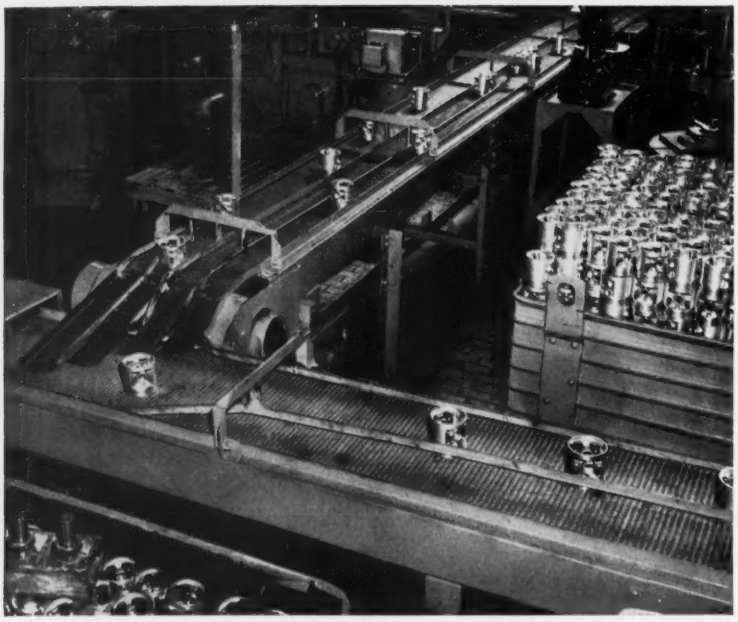
X-ite

IMPORTANT METAL SHOW ANNOUNCEMENT

We will be exhibiting castings made in Ceramic Molds and Ceramic-Sand Molds. Better casting surface finish, tolerances and thinner wall sections have been accomplished. See Booth No. 603.

For further information circle No. 59

Continuous Heat Treating Depends on Continuous Product Flow and...



Aluminum piston heads flow on Ashworth Balanced Weave design B 60-38-14. It affords the required smooth surface characteristics to facilitate transfer and minimize product marking.

ASHWORTH KEEPS YOUR PRODUCT ON THE MOVE... CONTINUOUSLY!

In brazing, hardening, quenching, annealing, tempering, washing, sintering . . . any operation that demands continuous product flow . . . Ashworth Metal Process Belts can help you reduce handling and maintenance costs.

Ashworth Metal Process Belts can be fabricated from any metal or alloy . . . with any required surface characteristic. Skilled Ashworth Engineers have designed these belts to withstand and operate at temperatures up to 2100°F. Ashworth open mesh design permits circulation of processing atmosphere, or free drainage of process solutions in quenching, pickling and tempering.

Engineering, plus accurate selection of wire analysis, plus careful fabrication insure quality woven into every Ashworth belt. You can depend on Ashworth to carry the load . . . continuously.

Consult your nearest Ashworth Sales Engineer or write directly to:

ASHWORTH BROS., INC.

WINCHESTER, VIRGINIA

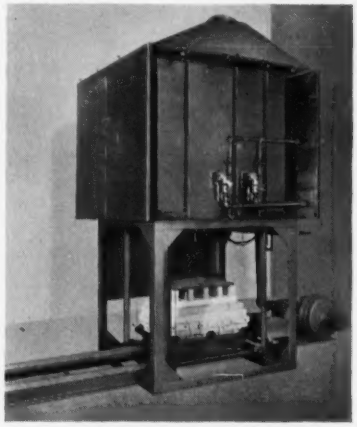
Sales Offices In Principal Cities

For further information circle No. 60

NEWS TO HEAT TREATERS

Harrop Gas Models

For a variety of applications ranging from laboratory testing procedures to high volume production, two lines of Harrop gas furnaces have recently been announced.



The Standard Model GF Series (shown here) is designed for continuous operation to 3000 F. The High Temperature GFHT Series will operate continuously up to 3300 F.

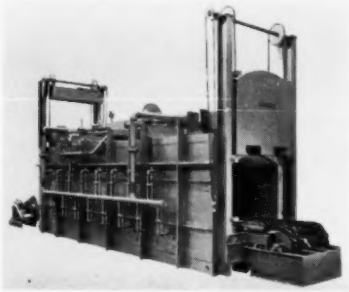
Once the gas and air ratio has been individually set at the burners, this ratio is constant in every position. Furnace temperatures can be controlled manually or by instruments.

The GF series includes cabinet, elevator and shuttle models, and the GFHT series includes elevator and swing arch models.

For further information circle No. 61

Hevi-Duty Export

Hevi-Duty Electric Company, has broadened its export market with its first shipment of a large gas-fired



conveyor furnace to the Orient.

The 32 ton furnace was transported by rail from Watertown to the port of Baltimore, and shipped from there to the Philippines. It will be used by Inter-Island Gas Service Company, Manila, for heat treatment of metals under a licensing agreement with Pressed Steel Tank Company, Milwaukee.

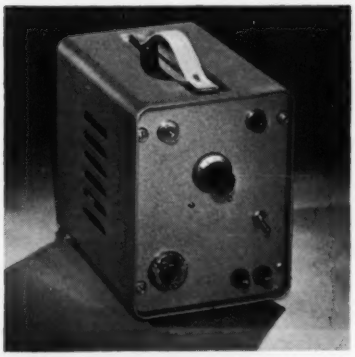
Hevi-Duty Electric has been doing export business with Central and South America and with Europe. Some smaller equipment has been sold in Japan and the Philippines, but this is the first shipment of a large industrial furnace by Hevi-Duty to the Orient.

For further information circle No. 62

Compact Temp Controller

A temperature controller designed to maintain temperature to within ±.01 F. in conjunction with adjustable or fixed type contact thermometers has been marketed by Compact Circuits Company, Newark, New Jersey.

The unit, with a temperature control to ±.005 F., may be maintained



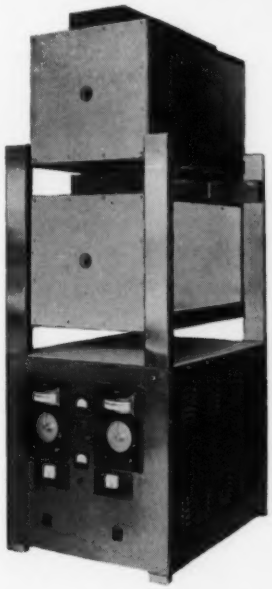
by feeding the unbalanced signal from a simple thermistor bridge to the input of the controller. The proportional controller output may be used as input to a property designed saturable reactor to control many kilowatts of heater power.

For further information circle No. 63

Huppert Tube Furnace

A new three zone diffusion tube furnace for tube temperatures up to 2300 F. has been developed by K. H. Huppert Company to meet specialized demands of the electronic industry.

Design versatility makes the new model suited for either laboratory



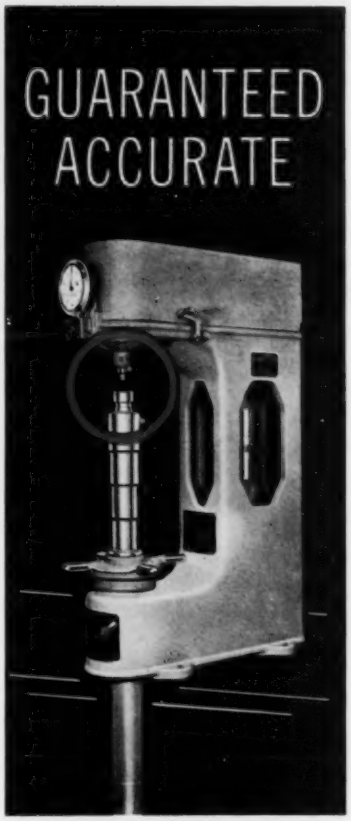
or production work. The furnace shown is a two tube unit—each with three zones of control—regulated by a program controller and saturable core reactor system providing constant uniform heat distribution in the 12 in. long center zone. End zones eight in. in length can be adjusted independently of the center zone to compensate for end losses. This model has 2½ in. I.D. tubes with a heating length of 28 in. Heating elements are made of Kanthal A-1, ¼ in. diameter rod, helically fabricated.

For further information circle No. 64

NERVA Contract Let

Aerojet General Corporation and Westinghouse Electric Corporation have been selected by federal agencies to work on the first phase of the development of the NERVA (Nuclear Engine for Rocket Vehicle Application) Program. The program is a part of Project ROVER—a joint AEC-NASA program for the development of a nuclear rocket propulsion system.

For further information circle No. 65



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Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10205 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC
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Missile-Age Accuracy

For further information circle No. 66

Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

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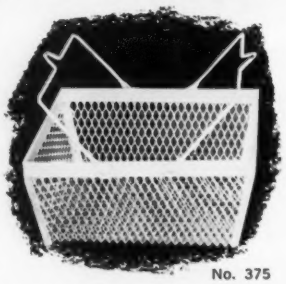
No. 377

Show us the part!

STANWOOD WILL BUILD A BETTER BASKET FOR THE JOB!

Show us the part or a drawing of the part to be heat treated and tell us the quantity — Stanwood will recommend a basket design that will assure you of easiest handling in and out of furnaces and through quenching — a basket that will last longer and reduce costs in your heat treating department or shop. These Stanwood Baskets are cutting costs day after day.



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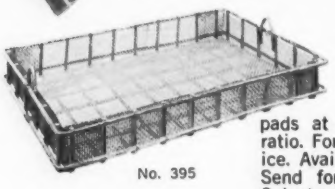

No. 395

No. 377 is a drop bottom basket for carburizing bearing cases in a cyanide furnace — one of many designs of drop bottom baskets. No. 375 is a basket for degreasing and washing small parts. No. 395 is a lightweight furnace basket with built-in pusher pads at ends. Exceptional strength to weight ratio. For high temperature and quenching service. Available with replaceable wire mesh liner. Send for Stanwood Heat Treating Equipment Selector — Shows typical baskets, trays, fixtures, parts, boxes, retorts and furnace parts.

STANWOOD (HEAT TREATING S EQUIPMENT) **CORPORATION**

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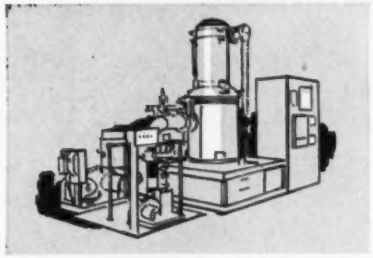
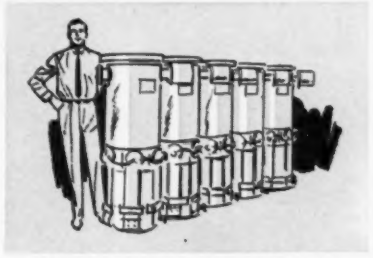
THESE HAYES VACUUM FURNACES WERE DESIGNED FOR INDUSTRIAL HEATING JOBS TOO HOT TO HANDLE BY OTHER FURNACES!

C. I. Hayes is *the pioneer* of vacuum heat treating furnaces. But more important, Hayes still leads today in the development of new, high-temperature, high-vacuum furnaces to meet the needs of Industry. Here are just a few examples of how Hayes solved tough and unusual heat treating problems with Vacu-Master furnaces . . . in each case coordinating furnace design with job requirements.

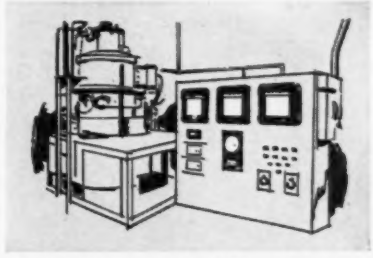
The *versatility* of Hayes Vacu-Master Furnaces has been proved . . . from sintering at temperatures to 4600° F to a wide variety of conventional applications including annealing, brazing, hardening, tempering, sintering and degassing. Perhaps *your* heat treating problem can be solved more efficiently, more economically with a Hayes Vacu-Master furnace.



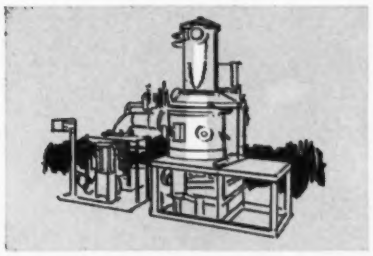
✱ **In Upper New York State,** this Hayes Vacu-Master operates in the 2200-2300°F Temperature range at sub-micron vacuum for brazing complex stainless steel assemblies. The Hayes cold-wall, fully water-jacketed furnace design provides most efficient cooling of the vacuum chamber . . . and contributes to operating comfort. On one job alone, the Vacu-Master has reduced reject rate four fold.



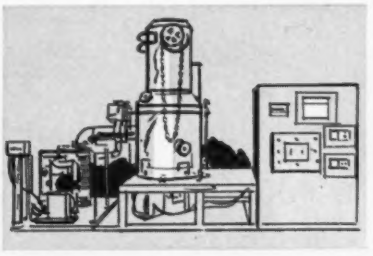
✱ **The Atomic Energy Division of a Delaware Corporation** utilizes the close temperature control (less than ± 10°F) of this high-speed Hayes Vacu-Master in the 2000°F range for a specialized processing job. Heating chamber of the Vacu-Master has no metal retort. Direct heating means extremely rapid cycling . . . higher quality processing at tremendous savings.



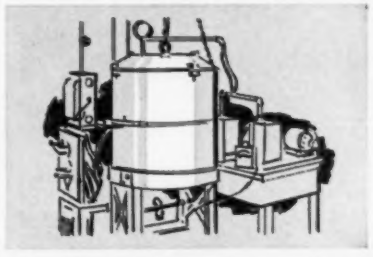
✱ **Installed In A West Coast Aircraft Plant,** this Hayes Vacu-Master provides automatic programmed control for a complex brazing operation. Temperature control of workpiece is within ±5°F. Vacuum processing plus high speed vacuum cooling insure correct metallurgical structure. Hayes Vacuum Furnaces feature saturable reactor controls to keep element and workload temperatures uniform . . . keep furnace downtime and maintenance to the minimum.



✱ **At Another New York Plant,** a beryllium-copper hardening job called for a furnace that could operate in the 650°F range within ±3°F — also a furnace capable of handling by simple changes in control settings Ni-Span C (1400°F range), stainless steel annealing, copper brazing, etc. The answer: this versatile Hayes Vacu-Master with wide-range temperature capabilities. The result: quality output without costly rejects.



✱ **Mid-West Auto Parts Manufacturer** proved the versatility of this Hayes Vacu-Master to handle general heat treating applications in 600°F to 2200°F temperature ranges. With it, the company has been able to perform economically many difficult annealing, hardening, and brazing operations.



✱ **FIRST Commercial Vacuum Furnaces** sold to industry were designed by Hayes in 1929 for one of the nation's largest electrical manufacturing firms. These production-scale vacuum furnaces were used for processing vacuum tube components. Advanced design features included full-jacket cold wall construction . . . way ahead of contemporary equipment! They're still working today!

Complete lab facilities are at your disposal *without cost.* And results are *guaranteed!* Write for Bulletins 5709A and 5709B describing Hayes Vacu-Master furnaces.

ELECTRIC CERTAIN CURTAIN FURNACES

*NAMES OF COMPANIES ON REQUEST.

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Established 1905

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VACUUM HEAT TREATING SYMPOSIUM

1. FURNACE DESIGN
2. INSTRUMENTS AND CONTROLS
3. VACUUM PUMPING SYSTEMS
4. PRACTICAL APPLICATIONS

COBO HALL, ROOM 3505, 2 to 5 P. M., OCT. 23rd

Visit HAYES Booth, 938 at the Metals Show

For further information circle No. 68

GET THE FACTS!

For the complete story of Benedict-Miller's high-speed salt bath and operational details, write for AJAX SALT BATH TIPS & TRENDS, Vol. 12, No. 2.

SEE AJAX... Booth 452, Metal Show

This commercial heat treaters' high-speed Ajax salt bath installation has meant

Uniform...Decarb-free...Straighter Work
HARDENED 2 TO 3 TIMES FASTER!

When Benedict-Miller Inc., well-known commercial heat treaters of Lyndhurst, N. J. installed their Ajax high-speed salt bath furnace they expected a lot in the way of better, lower cost results—and got even more! Here, after 3 years of constant use, is the way it stacks up:

WORK HANDLED IN 50% - 75% LESS TIME!

Regardless of size, shape or type of high-speed work, loads are handled in from 2½ to 4 hours as compared to 7 or 8 hours previously.

CHEAPER FIXTURES..... FASTER FIXTURING

Costly special alloy trays that necessitated painstaking fixturing of the work have been replaced with simple, easily-loaded carbon steel fixtures.

OUTSTANDING RESULTS ON T-TYPE COBALT STEELS.....

Hardness of R_c 66-68 is consistently obtained on critical cobalt steels such as T_2, T_4, T_5 and T_6. Decarburization is not a factor. Finish grinding is seldom needed. (Previously a minimum of .010" had to be allowed for grinding even though protective coatings were used on the work to reduce decarburization.)

PLUS THESE ADDITIONAL ADVANTAGES!

The same Ajax furnace and the same salt operate at any required temperature between 1750° and 2350°F. . . .

One daily rectification maintains bath neutrality. . . .

Partial hardening can now be done as needed. Because salt bath heating is so much faster than other methods, there is no danger of oversoaking light sections of pieces of varied thickness . . .

. . . And furnace maintenance has been lower than their best expectations.

AJAX

SALT BATH FURNACES

Internally heated electric and gas-fired types

AJAX ELECTRIC COMPANY

940 Frankford Avenue Philadelphia 23, Pa.

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